New genus of extinct Holocene gibbon associated with humans in Imperial China

Summary: We describe a new globally extinct genus and species of gibbon from a late Holocene royal tomb in China, representing the first documented primate extinction from a postglacial continental ecosystem, and suggesting that until recently eastern Asia supported a previously unknown, historically extinct endemic radiation of apes.

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Although all extant apes are threatened with extinction, there is no evidence for human-caused extinctions of apes or other primates in postglacial continental ecosystems, despite intensive anthropogenic pressures associated with biodiversity loss for millennia in many regions. Here we report a new, globally extinct genus and species of gibbon, *Junzi imperialis*, described from a partial cranium and mandible from a ~2,200-2,300 year-old tomb from Shaanxi, China. *Junzi* can be differentiated from extant hylobatid genera and the extinct Quaternary gibbon *Bunopithecus* using univariate and multivariate analyses of craniodental morphometric data. Primates are poorly represented in the Chinese Quaternary fossil record, but historical accounts suggest that China may have contained an endemic ape radiation that has only recently disappeared.

A Warring States period tomb excavated in 2004 at Shenheyuan, Xi'an (formerly the ancient capital Chang'an), Shaanxi, possibly attributable to Lady Xia, grandmother of China's first emperor Qin Shihuang (259-210 BC), contains 12 pits with animal remains (Fig. 1) (*1, 2*). Similar tomb menageries are known from other Chinese high-status burials of comparable age (*3*). Pit K12 contains skeletons of leopard (*Panthera pardus*), lynx (*Lynx lynx*), Asiatic black bear (*Ursus thibetanus*), crane (*Grus* sp.), domestic mammals and birds (*1*), and a gibbon (Shaanxi Provincial Institute of Archaeology, Shenheyuan M1K12:3).

Gibbons and siamangs (Hylobatidae) include four living genera (*Hoolock*, *Hylobates*, *Nomascus*, *Symphalangus*) containing 20 species (*4, 5*). Six extant species are known historically from China (*5, 6*). Gibbons were considered culturally significant throughout Chinese history; their perceived "noble" characteristics made them symbols of scholar-officials (*junzi*), and they became high-status pets from the Zhou Dynasty (1046-256 BC) (*7*). They are extremely scarce in China's Pleistocene-Holocene record, and most pre-modern remains are isolated teeth or postcrania insufficiently diagnostic for species-level or genus-level identification (*8, 9*). The most complete Quaternary Chinese hylobatid is a left mandibular fragment from Chongqing (AMNH-18534), probably early-middle Pleistocene in age, described in 1923 as an extinct genus and species, *Bunopithecus sericus* (*10*). In contrast, M1K12:3 includes a partial facial skeleton (missing the posterior neurocranium) with complete anterior dentition, left-right PM3-4 and right M1-2; an associated right M3; a partial mandible with almost complete anterior dentition (missing left I2), left-right pm3-4 and right m1-2; and non-diagnostic right distal forelimb elements (Fig. 1).

Destructive sampling of M1K12:3 was not possible due to the unique specimen's protected archaeological status, and previous attempts to amplify DNA from Chinese Holocene samples have often proved unsuccessful due to poor biomolecule preservation under subtropical conditions (*11*), so we conducted multivariate and univariate morphometric analyses to determine its affinities to other hylobatids. First, we conducted canonical variate analyses (CVA) using 16 cranial landmarks shared between M1K12:3 and a dataset including all extant hylobatid genera (*Hoolock*, n=53; *Hylobates*, n=327; *Nomascus*, n=34; *Symphalangus*, n=63) (*12*, *13*). We partially restored a three-dimensional scan of the M1K12:3 cranium before analysis, through mirror-imaging and reference-based reconstruction of the zygomatic bone, zygomatic arch, posterior maxilla and posterior frontal (*13*). Landmarks are distributed across nearly the entire remaining or restored cranial surface. All CVAs were performed using genus as classifying variable when assessing the position of M1K12:3 in morphospace.

Permutation tests (10,000 rounds) for between-group Procrustes and Mahalanobis distances show significant differentiation between all extant genera (p<0.0001, all comparisons), and between M1K12:3 and extant genera (Fig. 2, Table 1, Table S1). CV1 (60.90% variation) is associated with expansion of the facial region and primarily separates *Symphalangus*, the largest, most morphologically distinct hylobatid. CV2 (23.04% variation) represents shape changes to the frontal, orbit and infraorbital region, and strongly differentiates M1K12:3 from extant genera due to its expanded upper anterior neurocranium: M1K12:3 exhibits a more superior position of the frontal posterior margin (bregma, stephanion), the anterior margin (glabella, upper orbital rim) has undergone an inferior shift, the zygomaxillary suture is shortened to give a narrower cheekbone, and molar dentition is more widely set together with an inferior shift (Table S2). Posterior probabilities indicate extremely high classification accuracy (96-97%; Table S3), with M1K12:3 consistently classified as a separate group.

We collected molar (M1-3, m1-2) landmark data (homologous landmarks at main cusp tips, 20 (upper) or 22 (lower) semi-landmarks along outline), tooth crown areas (maximum occlusal area), polygon areas (ratio from lines connecting cusps relative to total occlusal area), and cusp angles (calculated from homologous landmark coordinates) from M1K12:3 (*13*). We compared these data with a new dataset containing morphometric data for 789 hylobatid molars representing 279 individuals (*Hoolock*, n=77; *Hylobates*, n=129; *Nomascus*, n=41; *Symphalangus*, n=32), including all extant Chinese species and AMNH-18534 (*13*).

Permutation tests (10,000 rounds) for Mahalanobis distances again show significant differentiation between all extant genera ($p<0.001$, all comparisons), although Procrustes distances do not consistently differentiate extant genera, especially *Nomascus* (Table S5). M1K12:3 is statistically differentiated from extant genera in several features including occlusal area (significantly larger M2, M3 and m2 than *Hylobates*; significantly smaller M1, m1 and m2 than *Symphalangus*), larger M3 paracone angle than *Nomascus*, and smaller protoconid, metaconid, entoconid and/or hypoconid angles than all genera (Fig. S4, Tables S6-S7). CVAs derived from semi-landmark data demonstrate the distinctive molar shape of M1K12:3. M3, m1 and m2 all fall outside the range of extant hylobatid variation (Fig. 2), and have high CVA classification accuracy (76-86%; Table S3). Permutation tests for Procrustes and Mahalanobis distances show significant differentiation between M1K12:3 and extant hylobatids for upper and/or lower molar outline; pairwise distances are greater than between extant genera (Table 1, Table S1). CVA for m2, the only tooth shared by M1K12:3 and AMNH-18534, demonstrates these specimens are also morphologically distinct (Fig. 2); *Bunopithecus* shows a very different relationship to extant hylobatids compared to M1K12:3, with a likely close relationship to *Hoolock* (*10*).

While these analyses cannot reconstruct M1K12:3's phylogenetic affinities, even genomic analyses have proved unable to clarify higher-order hylobatid relationships, possibly because living genera diverged through near-instantaneous radiation ~5 million years ago (*14*). However, cranial and molar data clearly differentiate M1K12:3 from living hylobatids and the only other Chinese Quaternary hylobatid. We therefore describe M1K12:3 as a new extinct genus and species, *Junzi imperialis* (*15*). Although other Holocene primate losses are known (21 extinctions in "ecologically naïve" Madagascan and Caribbean island faunas, with two species persisting beyond 1500 AD; *16, 17*), the disappearance of *J. imperialis* constitutes the first documented postglacial extinction of an ape, or of any continental primate.

Gibbons are today restricted to southwestern China (*6*), with closest populations >1,200km from Chang'an and separated by major drainages (Fig. 1). Large rivers can represent barriers to gene flow in hylobatids (*18*), providing biogeographic support for evolutionary differentiation of central Chinese gibbons. Chang'an was an important regional power centre under the Qin State and became China's political and economic centre during the Han Dynasty (*19*); gibbons could therefore have been transported to Chang'an as trade items or tributes. However, other mammals from the Shenheyuan tomb still occur in Shaanxi (*6*), suggesting a similar local origin for M1K12:3. Contemporary accounts describe gibbons being caught near Chang'an into the 10th century (*7*), and gibbon survival in Shaanxi until the 18th century (*20*). Southern Shaanxi represents the northern limit of China's subtropical forest ecoregion, and retains remnant populations of primates and other mammals (e.g. giant pandas) that co-occurred with gibbons in Quaternary assemblages (*6, 21*).

Global ecosystems have experienced extreme human-caused biodiversity loss in recent centuries, with extinction rates elevated by several orders of magnitude; it is increasingly accepted that a mass extinction is underway (*22, 23*). Eastern and southeast Asian biotas have been disrupted disproportionately: this region contains the most threatened mammals (*4*), and 73% of Asian primates are threatened compared to 60% globally (*24*). In China, two gibbon species (*Hylobates lar*, *Nomascus leucogenys*) have recently disappeared, surviving species are all critically endangered, and the Hainan gibbon (*Nomascus hainanus*) may be the world's rarest mammal with ~26 surviving individuals (*4*).

The background mammalian extinction rate is estimated at 1.8 extinctions/million species/year (*22*). As 525 Holocene-Recent primates, including 27 apes, are recognized (*5, 24, 25*), expected background extinction rates are 9.45×10^{-4}/year for primates, and 4.86×10^{-5}/year for apes. We could therefore expect 11.1 background primate extinctions and 57% probability of background ape extinction across the 11,700-year Holocene (although only 45% probability of primate extinction and 2% probability of ape extinction since 1500 AD, the IUCN threshold used to assess human-caused extinctions (*4*), and the period into which *J. imperialis* likely persisted). A hypothesis of "natural" rather than anthropogenically-mediated extinction of *J. imperialis* therefore cannot be discarded completely. However, few extinctions across the climatically stable Holocene can even questionably be interpreted as non-anthropogenic (*16*). Central Chinese landscapes have supported amongst the world's highest human densities for millennia (*19*), and experienced extensive Holocene mammal extinctions (*21*). The discovery of M1K12:3 in a tomb provides direct evidence of human exploitation, and extensive deforestation occurred near Chang'an during the late Imperial period, with remaining high-elevation forests representing suboptimal gibbon habitat (*26*). Analysis of predictors of Chinese Holocene mammal range loss has shown that best-supported models include an index of anthropogenic impact (*21*), and reconstruction of historical gibbon decline across China demonstrates extinction following a wavefront of directional pressures that matches known human population expansion (*20*).

Although primates are disproportionately threatened today (*24*), previous studies suggest they have not experienced elevated levels of past extinction (*27*). However, they are under-represented in Quaternary archives, which remain understudied across most areas of primate distribution (*8*, *21*). Our description of *J. imperialis* suggests past human-caused primate diversity loss may be underestimated, with important implications for understanding extinction vulnerability and informing conservation (*24*). Our findings also emphasize the extreme vulnerability of hylobatids even compared to other primates. Historical records document former gibbon occurrence across central and southern China (*7, 20*), in areas separated from distributions of extant species and *J. imperialis* by major drainages (Fig. 1). These populations may represent undescribed extinct species, suggesting much greater historical loss of global ape diversity. We encourage further investigation of Asian environmental archives to reconstruct past human-caused biodiversity loss in this global conservation hotspot, and provide new insights for understanding faunal vulnerability and resilience to help prevent future extinctions.

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Data and materials availability: All data needed to evaluate the conclusions in the paper are present in the paper or the Supplementary Materials.

Supporting Online Material

Materials and methods

Systematic paleontology

Figs. S1 to S4

Tables S1 to S7

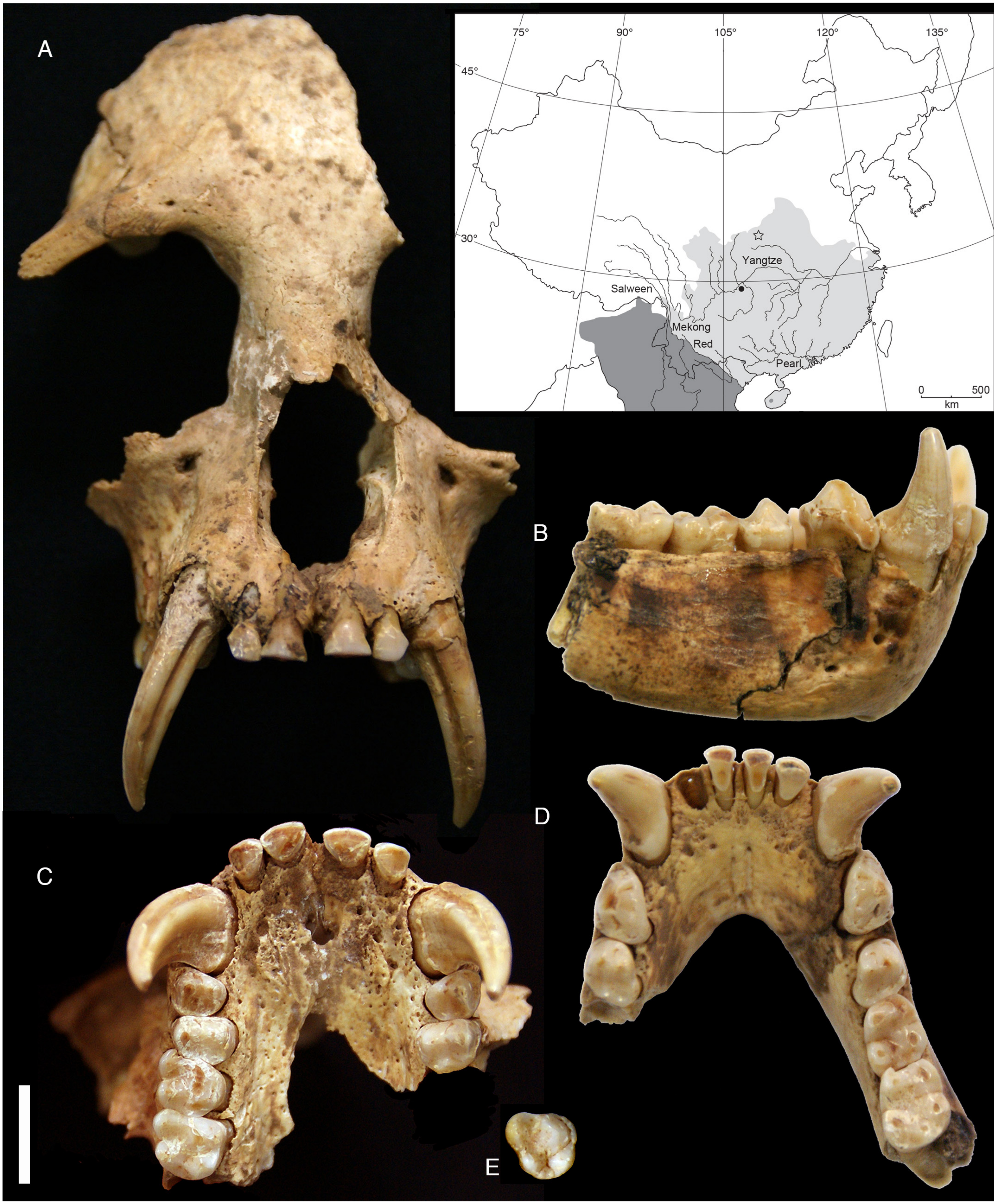
References (*28*–*44*)

Fig. 1. Cranium and mandible of *Junzi imperialis* holotype (M1K12:3): **A**, cranium, anterior view; **B**, mandible, lateral view; **C**, upper dentition, occlusal view; **D**, lower dentition, occlusal view; **E**, right M3. Scale bar=10mm. Inset, Modern distribution of hylobatids (dark grey; modified from ref. 18) and historical distribution across China (pale grey; modified from ref. 20), showing Chang'an (star), *Bunopithecus sericus* collection locality (filled circle), and major rivers.

Fig. 2. Plots of first two canonical variates (CV1-2) of hylobatid cranial and molar analyses. M1K12:3, red; *Bunopithecus*, black (m2 only); *Hoolock*, green; *Hylobates*, orange; *Nomascus*, purple; *Symphalangus*, blue. Cranial plot includes both reconstructions of M1K12:3.

Table 1. Comparisons between M1K12:3 and extant hylobatids for permutation tests (10,000 rounds) of cranial and molar Procrustes and Mahalanobis distances (bold, significant difference).

Extant hylobatid genus	**Procrustes distance**						**Mahalanobis distance**					
	Cranium	M1	M2	M3	m1	m2	Cranium	M1	M2	M3	m1	m2
Hoolock	**>0.001**	0.164	0.116	0.117	0.222	0.092	**>0.001**	0.099	0.075	**0.030**	**0.005**	**0.006**
Hylobates	**>0.0001**	0.345	0.165	0.191	0.053	**0.035**	**>0.0001**	0.161	0.128	**0.034**	**0.010**	**0.003**
Nomascus	**0.001**	0.437	0.263	0.152	0.399	0.141	**>0.001**	0.296	0.401	0.062	**0.018**	**0.042**
Symphalangus	**>0.001**	**0.030**	0.065	0.054	0.823	0.343	**>0.001**	0.126	**>0.001**	0.052	0.088	**0.004**



A
B
C
D
E
75°
90°
105°
120°
135°
45°
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Yangtze
Salween
Mekong
Red
Pearl
0
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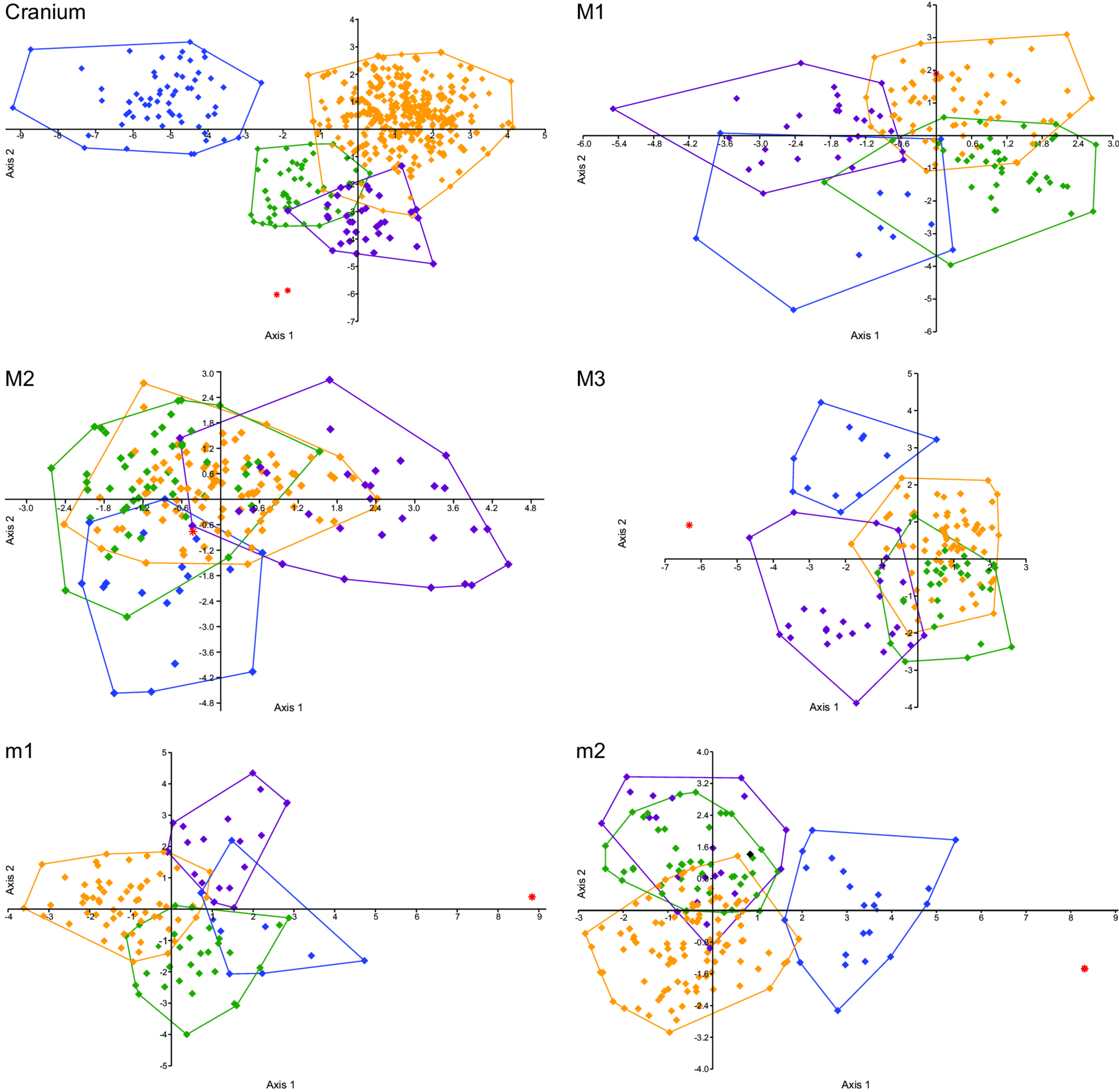

Cranium
Axis 1
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M1
Axis 1
Axis 2
M2
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Axis 2
M3
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m1
Axis 1
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m2
Axis 1
Axis 2

Supporting Online Material: Materials and methods

1. ZOOARCHAEOLOGICAL DATA COLLECTION

The fragile facial skeleton and mandible of M1K12:3 were scanned at the Shaanxi Provincial Institute of Archaeology using a NextEngine 3D Laser Scanner to capture the entire available surface morphology. ScanStudioHD software (NextEngine, 2006) was used to operate the scanner; we utilized the software's scan-editing features to volume-merge two separate 360° scans that captured the specimen in different orientations, to incorporate as much surface morphology as possible for analysis. This merged three-dimensional scan was used for all subsequent cranial, mandibular, and molar morphometric analyses.

2. CRANIAL DATA

Reconstructing M1K12:3

The most superior section of the maxilla of M1K12:3, which forms the narrowest region connecting orbital rim to nasal aperture, is damaged on the right side and has previously been repaired with plaster material. There is also some evidence of taphonomic distortion of the cranium: the right dentition is located slightly more anterior to the left dentition in what appears to be an unnatural degree of asymmetry, which is probably partly caused by the fact that the medial palatine suture is obliterated and the resultant gap between both sides of the palate has been filled with plaster material. There may also be further left/right displacement effects on anatomy located further superior to the palate region. To address this distortion, we only used the better-preserved right side for shape analyses to avoid the confounding effects of this bilateral asymmetry on results. We removed the plastered area on the upper right maxilla from the three-dimensional scan using Avizo 9.0 (Visualisation Sciences Group, Inc.) and mirror-imaged the preserved area from the left side across the midsagittal plane to restore the upper right maxilla. We also mirror-imaged the better-preserved lower margin of the left orbital rim to restore lost morphology on the right side.

Areas not possible to be restored by mirror-imaging can be estimated through reference-based reconstruction techniques, in which a specifically selected complete reference specimen that is morphologically similar to the target specimen is used to predict missing areas by a thin-plate spline interpolation. The accuracy of such reconstruction depends on the morphological distance between the attempted reconstruction and preserved morphology. Almost all of the neurocranium is missing in M1K12:3, and so any attempt to reconstruct this region when only facial morphology remains would be too extreme to be successful; the extent of an accurate reference-based reconstruction in M1K12:3 is therefore limited to estimating the zygomatic bone, zygomatic arch, posterior maxilla (with M3), and posterior frontal bone. We made three-dimensional scans of two reference crania using the methods described above (*Nomascus concolor*: NHM 33.4.1.2; *Hylobates lar*: NHM 55.1499). These taxa were chosen because M1K12:3 appears relatively similar to *Nomascus* in some facial characteristics (sharing the weakly protruding browridge and high, steep anterior frontal bone characteristic of *Nomascus* relative to other gibbons), and because the high degree of overall morphological similarity between extant gibbons permits selection of references from >1 genus to investigate the extent of morphological variation in producible reconstructions.

We followed the reference-based reconstruction protocol developed by ref. 28. On both reference specimen scans, the midsagittal plane was computed and the entire left hemicranium was removed, and areas on the right hemicranium not selected for reconstruction (the entire neurocranium other than the frontal bone) were selected for removal, to leave only areas congruent with the preserved morphology of M1K12:3 and areas targeted for reconstruction. On the resultant surfaces, we digitized a template for each reference formed of 11 landmarks (bregma, canine fossa, foramen infraorbitale, frontotemporale, glabella, jugale, nasale, nasospinale, orbitale, prosthion, rhinion), 129 curve semi-landmarks (alveolar margin, n=20; anterior nasal aperture, n=9; frontotemporal-zygomatic, n=14; lower zygomatic arch, n=21; midsagittal external, n=25; orbital rim, n=20; upper zygomatic arch, n=20), and 300 surface semi-landmarks, using Viewbox software (dHAL Software, Kifissia, Greece) to map the remaining geometry on the cranial surface; we then used this template to digitize M1K12:3 (the target) with a similar landmark and semi-landmark configuration.

While landmarks remained fixed, we allowed semi-landmarks in both the reference and target specimens to slide along curves (1 degree of freedom, DoF) and surfaces (2 DoF) in order to minimise the bending energy of the thin-plate spline computed between reference and target. Landmarks and semi-landmarks occurring in missing areas of the target specimen (i.e. posterior frontal bone, posterior maxilla, zygomatic bone, zygomatic arch) were declared 'free' and could move without constraints (3 DoF). We then projected the sliding semi-landmarks back onto their respective curves and surfaces. We repeated this spline relaxation and projection process up to a maximum of five times until obtaining a minimum bending energy value, at which point it was necessary to determine by visual inspection whether designating a semi-landmark as "missing" or "present" was correct anatomically, as semi-landmarks that occur around the edges of preserved morphology may fall into either category after sliding. We reclassified any semi-landmarks that did not fit their original designation and repeated the above sliding process with this adapted semi-landmark coding, repeating this process as many times as was necessary to optimise the distribution of semi-landmarks. Following this repeated process, all points between reference template and target specimen can be considered geometrically corresponding (*29*). We interpolated using the TPS function to transform the 440 landmarks and semi-landmarks of the reference template into the corresponding landmarks and semi-landmarks of M1K12:3, and to warp the surface of the reference template into the area of the target such that the relative transformation required the least possible bending energy. We conducted this process separately for the *Nomascus* and *Hylobates* reference specimens, resulting in two individual reconstructions of M1K12:3 (Fig. S2).

Comparative dataset and landmark data

The comparative dataset used to investigate the cranial morphological affinities of M1K12:3 comes from data collected by ref. 12, the largest available dataset of hylobatid three-dimensional cranial measurements. This dataset consists of 34 three-dimensional anatomical landmarks (Fig. S1) distributed across the cranial surface of 477 hylobatid crania, representing all four extant genera and nearly all extant species: *Hoolock* (*H. hoolock*, *H. leucogenys*, *H. tianxing*), n=53; *Hylobates* (*H. agilis*, *H. albibarbis*, *H. klossii*, *H. lar*, *H. moloch*, "*H. muelleri*" [combined sample of *H. abbotti*, *H. funereus* and/or *H. muelleri*], *H. pileatus*), n=327; *Nomascus* (*N. annamensis*, *N. concolor*, *H. gabriellae*, *N. leucogenys*, *N. siki*), n=34; *Symphalangus* (*S. syndactylus*), n=63 (nomenclature adjusted to reflect currently accepted hylobatid taxonomy; *4*). It is therefore sufficiently extensive and diverse to be representative of the extent of cranial morphological variation between extant hylobatids.

We employed landmark-based geometric morphometric techniques (*30*) to analyze cranial shape variation. Of the 34 landmarks available in the comparative dataset, it was possible to place 16 (orbitale interior, zygoorbitale, zygomaxillare, nasomaxillare, nasale, nasospinale, prosthion, postmolare II, bregma, glabella, nasion, nasomaxillary suture, orbitale superior, frontomalare orbitale, stephanion, frontomalare temporale) on the surface of the completed reference-based reconstructions (Fig. S1). All other landmarks were omitted either because they occupied areas not able to be reconstructed, or because precise landmark location on existing morphology was ambiguous due to damage or difficulty extracting surface detail from scan data. We then digitized three-dimensional landmark points on the reconstructions of M1K12:3 using Landmark software version 3.0.0.6 (*31*).

Statistical analyses

We used the software package MorphoJ (*32*) to conduct all geometric morphometric analyses of landmark data. We investigated two different datasets of varying landmark number. First, we analyzed all 34 landmarks without including the reconstructions of M1K12:3, to establish the extent of overall cranial shape variation between the four extant hylobatid genera and determine whether distinct morphotypes can be identified using these data. We then conducted a separate analysis using only the reduced set of 16 landmarks and including the compatible reconstructions of M1K12:3, to assess the morphological affinities of this specimen to extant hylobatids.

We performed Procrustes analysis to eliminate all non-shape elements of variation in the dataset (scaling, rotation and translation), and prepare landmark data to be in the right format for statistical analysis. We then conducted Principal Component Analysis (PCA) and Canonical Variate Analysis (CVA) of all 34 landmark shape coordinates, and conducted permutation tests (10,000 random permutation rounds) to test for significant shape differences between genera. PCA was unable to differentiate between extant hylobatid genera (results not shown), and so only CVA was used in subsequent analyses.

We then conducted CVA and permutation tests for the reduced dataset containing 16 landmarks and M1K12:3, both to explore how successfully the reduced landmark number was able to replicate results from the 34-landmark analysis, and also to determine the morphological and taxonomic affinities of M1K12:3 to the comparative hylobatid dataset. The two separate reconstructions of M1K12:3 were analysed together in cranial shape analyses as a combined "population" of two samples; each reconstruction was also analysed on its own against the comparative hylobatid dataset using the reduced 16-landmark analysis, with no difference in results (results not shown).

3. MOLAR DATA

Comparative dataset

The comparative molar sample comprises a total of 279 individuals (789 M1-3, m1-2 teeth) representing all four extant hylobatid genera (Table S4). We collected data from skeletal collections in the following institutions: American Museum of Natural History, New York (AMNH); Institute of Zoology, Chinese Academy of Sciences, Beijing (IOZ); Kunming Institute of Zoology, Chinese Academy of Sciences, Kunming (KIZ); Museum of Comparative Zoology, Cambridge, Massachusetts (MCZ); Natural History Museum, London (NHM); South China Institute of Endangered Animals, Guangzhou (SCIEA); National Museum of Natural History, Washington, D.C. (USNM); Zoological Museum, Vietnam National University, Hanoi (ZMVNU). We obtained provenance information from museum records, and nomenclature was again adjusted to reflect currently accepted hylobatid taxonomy (*4*). No antimeres were included. We also included the m2 of the holotype of *Bunopithecus sericus* (AMNH-18534; with no known paratypes; *10*).

Data for different specimens were collected using either digital photographs or a NextEngine 3D Laser Scanner. There are no significant differences in molar crown area between data derived from digital photographs and from screenshots of the 3D surface models, in specimens for which both datasets are available (t = -0.457, df = 18, p = 0.653).

Data acquisition and statistical analyses

We conducted all analyses on high-resolution images of the occlusal surface of teeth taken with either a Canon Digital Rebel XT camera with a 75-300 mm lens (for skeletal material) or Amira imaging software (FEI; for laser scans). We oriented each tooth independently following well-known protocols described elsewhere (*10*, *33*–*35*). We imported digital images of the upper and lower molars into Adobe Photoshop® to align the longitudinal groove with the y-axis and the main buccolingual groove with the x-axis. We mirror-imaged right teeth to correspond to the left side, and treated them as such for landmark digitizing and analyses.

Although cusp areas were successfully used in a previous analysis of the dental affinities of *Bunopithecus* to extant hylobatids, we could not use the same set of variables in this study, as most fissures separating the molar cusps of the teeth of M1K12:3 are obliterated by wear or damage. Instead, we collected morphometric data on crown outline, cusp angles, and crown and polygon areas of these teeth. We placed homologous landmarks at the cusp tips of the four (upper molars) or five (lower molars) main cusps using tpsDig 232 (*36*) (Figs S3-S4). We used these landmarks to calculate the cusp angles formed by the lines connecting the apices of three given adjacent cusps, which were only digitized on unworn or minimally worn teeth (up to wear stage 3 of ref. 37). Similarly, we calculated polygon area as a ratio of the area enclosed by the four (upper molars) or five (lower molars) main cusps relative to the overall crown size. Finally, we collected the crown outline of each tooth in tpsDig 232 (*36*), which allows the automatic placement of coordinates along the 2D contour of an object, using 20 and 22 equidistant semi-landmarks on the upper and lower molars, respectively (Figs S3-S4). We also collected crown area measurements in Adobe Photoshop® from photographs of those teeth in which a millimetre scale was originally added. All occlusal photographs/screenshots and landmarks and area measurements were collected by AO.

We then conducted multivariate analyses on crown outline data. We were unable to collect outline or polygon area for the M1 of M1K12:3 due to damage on its distolingual portion, and could only use data for angles associated with protocone, paracone and metacone of this tooth. We transformed semi-landmarks using a Generalized Procrustes Analysis to remove differences in size and orientation between individuals, conducted PCAs, and used the principal component coordinates to calculate Mahalanobis and Procrustes distances. We also conducted CVAs to determine generic differences between hylobatids and the molar shape affinities of M1K12:3. We quantified accuracy of CVAs by determining the percent of individuals correctly classified. We conducted all analyses in MorphoJ (*32*) and PAST (*38*).

Supporting Online Material: Systematic paleontology

Order Primates Linnaeus 1758

Suborder Haplorhini Pocock 1918

Parvorder Catarrhini Geoffroy 1812

Superfamily Hominoidea Gray 1825

Family Hylobatidae Gray 1870

Remarks: The skull, mandible and dentition of M1K12:3 exhibit a series of key diagnostic characteristics of the Hylobatidae (*39, 40*), including: a small, shallow face with a modest brow ridge; large orbits with protruding rims which are relatively larger than found in the rest of the Hominoidea; a shallow, gracile mandible; long canines with relatively large proximal bucco-lingual width, tapering to a narrow distal point, and with a distinct mesial sectorial ridge running the length of the tooth; low-crowned, relatively simple molars with low and rounded cusps, with a subrectangular crown outline and rounded corners, and with a simple fissure pattern with minimal and poorly defined crests and no secondary wrinkling; upper molars with four cusps, lower molars with five cusps.

Genus *Junzi* gen. nov.

Type species: *Junzi imperialis* gen. et sp. nov.

Etymology: *Junzi*, from the pinyin (standard mainland Chinese phonetic alphabet) transliteration of 君子, meaning "scholarly gentleman" or "man of virtue or noble character". Gibbons were widely regarded as a symbol of scholar-officials or *junzi* in ancient China, as the perceived “noble” characteristics of gibbons were considered to accord with the aesthetic taste of both Daoism and traditional Chinese scholars (*7*, *41*).

Diagnosis: *Junzi* differs from extant and extinct hylobatid genera according to the following characters:

Compared to *Hoolock*, has a steeper frontal region; a more superior nasal bone; an inferior expansion along the lower margin of the nasal aperture; a smaller metaconid angle on m1; a smaller protoconid angle on m2; an entoconid facing the protoconid on m1 and m2; and a more inferior position of m2.

Compared to *Hylobates*, has a steeper frontal region; a more superior nasal bone; an inferior expansion along the lower margin of the nasal aperture, which also protrudes further forward posteriorly together with the position of the prosthion; a larger total occlusal area on M2, M3 and m2; no evidence of M3 reduction; a smaller metaconid angle on m2; a more inferior position of m2; and lacks accessory cusps and crests (e.g. mesial marginal accessory cusps,crista/cristid oblique) in post-canine teeth.

Compared to *Nomascus*, has a steeper frontal region; a more superior nasal bone; an inferior expansion along the lower margin of the nasal aperture, which also protrudes further forward posteriorly; a larger paracone angle on M3; a smaller protoconid angle on m1; a smaller metaconid angle on m2; an entoconid facing the protoconid on m1 and m2; a more inferior position of m2; and lacks well-developed cingular structures in post-canine teeth except for M3, which shows a well-developed lingual cingulum.

Compared to *Symphalangus*, has a steeper frontal region; an enlarged orbit characterized by a lateral and inferior shift; a flatter and smaller nasal bone; a more superior prosthion; a more antero-inferior position of m2; an overall shorter alveolar rim; a smaller total occlusal area on M1, m1 and m2; a smaller protoconid angle on m1;

a smaller entoconid angle on m2; an entoconid facing the protoconid on m1 and m2; and lacks vertical wrinkles on the lingual surface of the protocone.

Compared to *Bunopithecus*, has larger lower molars as a result of distal molar expansion associated with expansion of the talonid (such that the overall area of the talonid is larger than that of the trigonid, rather than having a trigonid larger than the talonid as in *Bunopithecus*), and has a smaller buccolingual mesial/distal molar ratio; and m2 rather than m3 is the biggest tooth in the molar row.

Description: The face is small and shallow, and the frontal, nasal and maxilla are not prognathic compared to Old World monkeys of a similar size. The frontal is gracile with a small indistinct brow ridge; steeply oriented; descending to a narrow nasal aperture with a short nasoalveolar clivus. The maxilla protrudes anteriorly to accommodate enlarged canine roots; infraorbital foramina are present, parallel in position with the upper canines. The frontozygomatic suture is positioned anteriorly. The orbits are relatively large and subcircular, with distinctive orbital rims. The mandible is shallow and gracile, narrow anteriorly with an elongated posterior palatal width. The mandibular body is relatively robust with no mental protuberance, and the mental foramen is parallel with the canines and p3.

The dental formula is 2.1.2.3. The incisors are relatively small and spatulate, with a concave lingual surface. The upper and lower canines are relatively large, such that canine size is at the upper end of the range of variation of extant hylobatids; with relatively large proximal bucco-lingual width, tapering to a narrow distal point, and with a distinct mesial sectorial ridge running their length. Upper premolars possess two main low and rounded cusps, the paracone and protocone; the protocone is less elevated than the paracone. P4 is slightly larger than P3 due to presence of a small and low tubercle on the distolingual portion of the tooth crown, and a barely discernible distobuccal tubercle at least on the left P4. Mesiodistally, greatest length of P3 is on its buccal portion, and greatest length of P4 is on its lingual portion. The p4 is trapezoidal-shaped due to the presence of a very well-developed entoconid. Overall, p4 shape resembles that of *Hoolock hoolock* from Myanmar (*5*), and differs from the oval or round configuration more commonly seen in other hylobatids.

The molars are relatively simple, with low conical cusps and no accessory cusps or crests. The upper molars show the standard hominoid crown configuration, with a subrectangular outline and four low and rounded cusps. A crista obliqua connecting the paracone and metacone is absent or poorly defined. The lingual cusps are less elevated than their buccal counterparts, although this feature is less marked in M3. The hypocone in M1 is relatively small. The protocone is the most well-developed cusp, followed by the metacone. In contrast, the hypocone in M2 and M3 is well-developed, and in M2 is only marginally smaller than the protocone, with all cusps being approximately equal in size. M3 exhibits a small cusp 5 and possibly also a cusp 6 on the distal portion of the tooth. The lower molars also possess a subrectangular crown configuration with well-rounded corners and low cusps, exhibiting the standard hominoid five cusps with a Y-shaped fissure pattern. The crown outline flares slightly distally, so that the talonid is broader than the trigonid. The lingual cusps are slightly more elevated than both the protoconid and the hypoconid. The metaconid is the largest cusp in both m1 and m2. No accessory cusps are present. The entoconid faces the protoconid on m1 and m2. The hypoconulid is centrally located.

Molar proportions show a unique pattern, in which M2 is only marginally larger than M3, and M1 is considerably smaller; extant hylobatids tend to have M1 and M3 that are subequal in size, with M2 being considerably larger. There is no evidence of M3 reduction. Molars also possesses smaller polygon areas relatively to crown size, suggesting that the cusps are more externally placed than in extant hylobatids. Linear measurements for both upper and lower molars are only slightly larger mesiodistally than buccolingually, with length-breadth indices as follows: M1, 0.98; M2, 1.02; M3, 0.91; m1, 1.10; m2, 1.32. The angle of the paracone is the largest cusp angle in all upper molars, in contrast to all extant hylobatids, and the protocone has a relatively small angle. The angle of the metacone is the largest angle in M2, and the smallest angle in M3. The angles of the protoconid and metaconid are the smallest angles in both m1 and m2, while the angle of the entoconid in m2 is on average the largest for all hylobatid teeth examined.

***Junzi imperialis* gen. et sp. nov.**

Holotype: Shenheyuan M1K12:3 (Fig. 1), comprising a partial facial skeleton missing the posterior neurocranium, with complete anterior dentition, left and right PM3-4 and right M1-2; an associated right M3; and a partial mandible with almost complete anterior dentition (missing left I2), left and right pm3-4 and right m1-2; and right distal forelimb elements.

Etymology: Referring to the discovery of the holotype in a Warring States period imperial or high-status tomb (possibly the tomb of Lady Xia).

Common name: Lady Xia's gibbon or Imperial gibbon.

Type locality: Northwest Shenheyuan plateau (north of the Yu River), Chang'an District, Xi'an Municipality, southern Shaanxi Province, China.

Age: Site not directly dated, but probably from late Warring States period of Zhou Dynasty (*c.*2,200–2,300 BP).

Diagnosis: As for genus.

Description: Morphological description as for genus. Measurements of holotype as follows:

Cranium: I1 buccolingual diameter = 3.94 mm; I1 mesiodistal diameter = 4.91 mm; I2 buccolingual diameter = 4.27 mm; I2 mesiodistal diameter = 4.05 mm; C1 buccolingual diameter = 6.37 mm; C1 mesiodistal diameter = 9.70 mm; C1 labial height = 22.16 mm; P3 buccolingual diameter = 6.29 mm; P3 mesiodistal diameter = 5.26 mm; P4 buccolingual diameter = 6.90 mm; P4 mesiodistal diameter = 5.37 mm; M1 buccolingual diameter = 7.17 mm; M1 mesiodistal diameter = 7.02 mm; M2 buccolingual diameter = 7.81 mm; M2 mesiodistal diameter = 7.98 mm; M3 buccolingual diameter = 7.78 mm; M3 mesiodistal diameter = 7.05 mm; interorbital breadth = 10.31 mm; nasion-nasospinale = 33.22 mm; maximum nasal width = 14.19 mm; canine interalveolar distance = 19.06 mm; palate depth at M1 = 10.88 mm.

Mandible: p3 buccolingual diameter = 8.08 mm; p3 mesiodistal diameter = 4.85 mm; p4 buccolingual diameter = 5.02 mm; p4 mesiodistal diameter = 6.63 mm; m1 buccolingual diameter = 5.85 mm; m1 mesiodistal diameter = 6.45 mm; m2 buccolingual diameter = 6.43 mm; m2 mesiodistal diameter = 8.48 mm; symphyseal height = 21.40 mm; distance between left and right symphyseal fossae = 19.80 mm.

Additional upper and lower molar measurements are given in Tables S6-S7.

The following taxonomically non-diagnostic right distal forelimb elements are also preserved: distal fragment of radius (maximum length = 143.37 mm); distal fragment of ulna (maximum length = 71.77 mm); seven carpals; three metacarpals (largest is the 3rd or 4th right metacarpal; maximum length = 76.53 mm); and four phalanges (1st midline phalange, maximum length = 58.33 mm; 2nd midline phalange, maximum length = 55.56 mm; broken phalange, maximum preserved length = 35.07 mm; small phalange, maximum length = 23.75 mm).

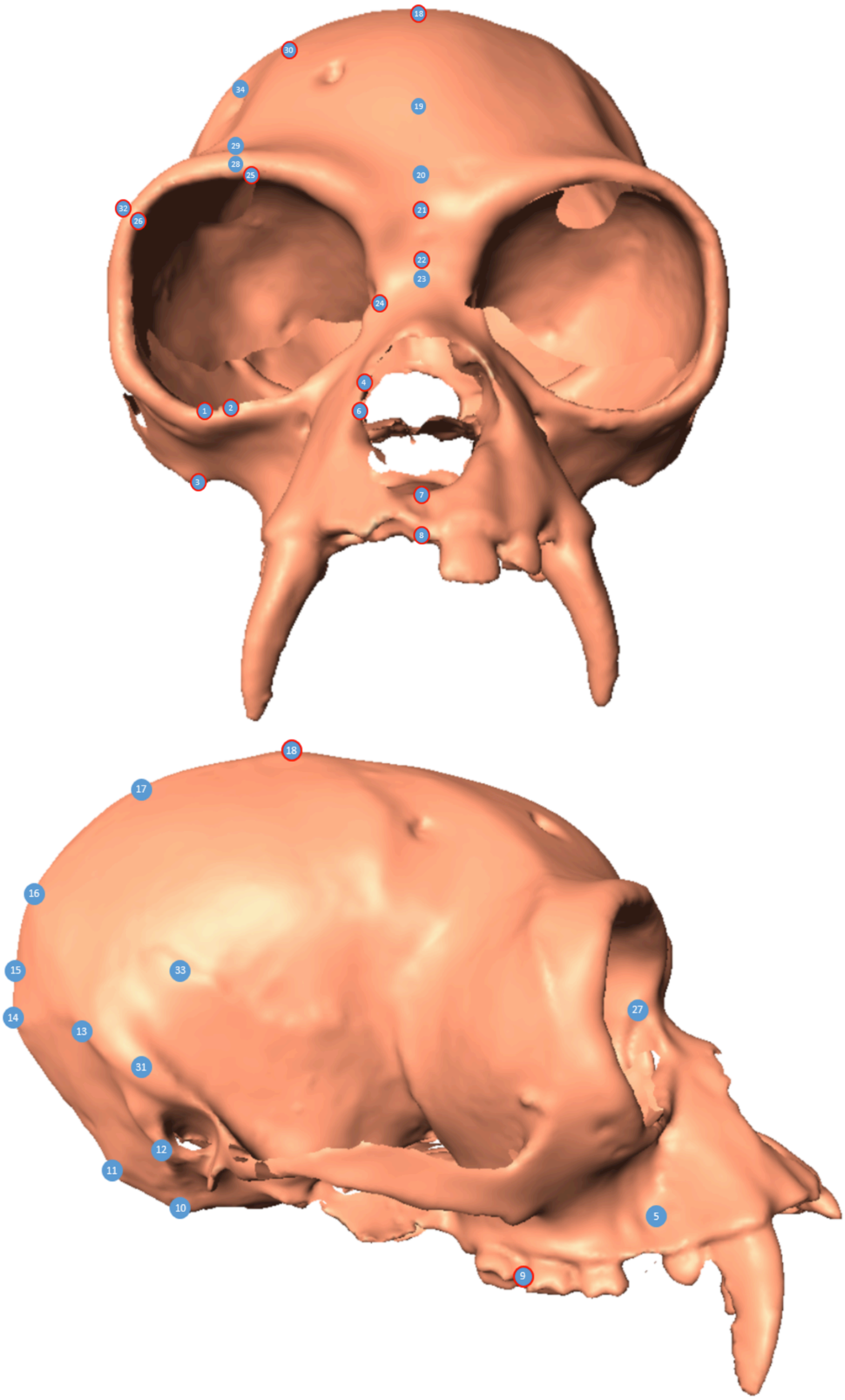

Figure S1. Gibbon cranial landmarks available in Creel and Preuschoft (1976); landmarks used in this study for comparative analysis indicated in red. 1, orbitale inferior; 2, zygoorbitale; 3, zygomaxillare; 4, nasomaxillare; 5, maxillary incision; 6, nasale; 7, nasospinale; 8, prosthion; 9, postmolare II; 10, basion; 11, opisthion; 12, mastoidale; 13, asterion; 14, inion; 15, opisthocranion; 16, lambda; 17, lambda-bregma apex; 18, bregma; 19, bregma-nasion apex; 20, supraglabella; 21, glabella; 22, nasion; 23, nasal roof; 24, nasomaxillary suture; 25, orbitale superior; 26, frontmalare orbitale; 27, maxillofrontale; 28, torion; 29, supratorion; 30, stephanion; 31, supramastoidal crest; 32, frontomalare temporale; 33, euryon; 34, parietal vault elevation.

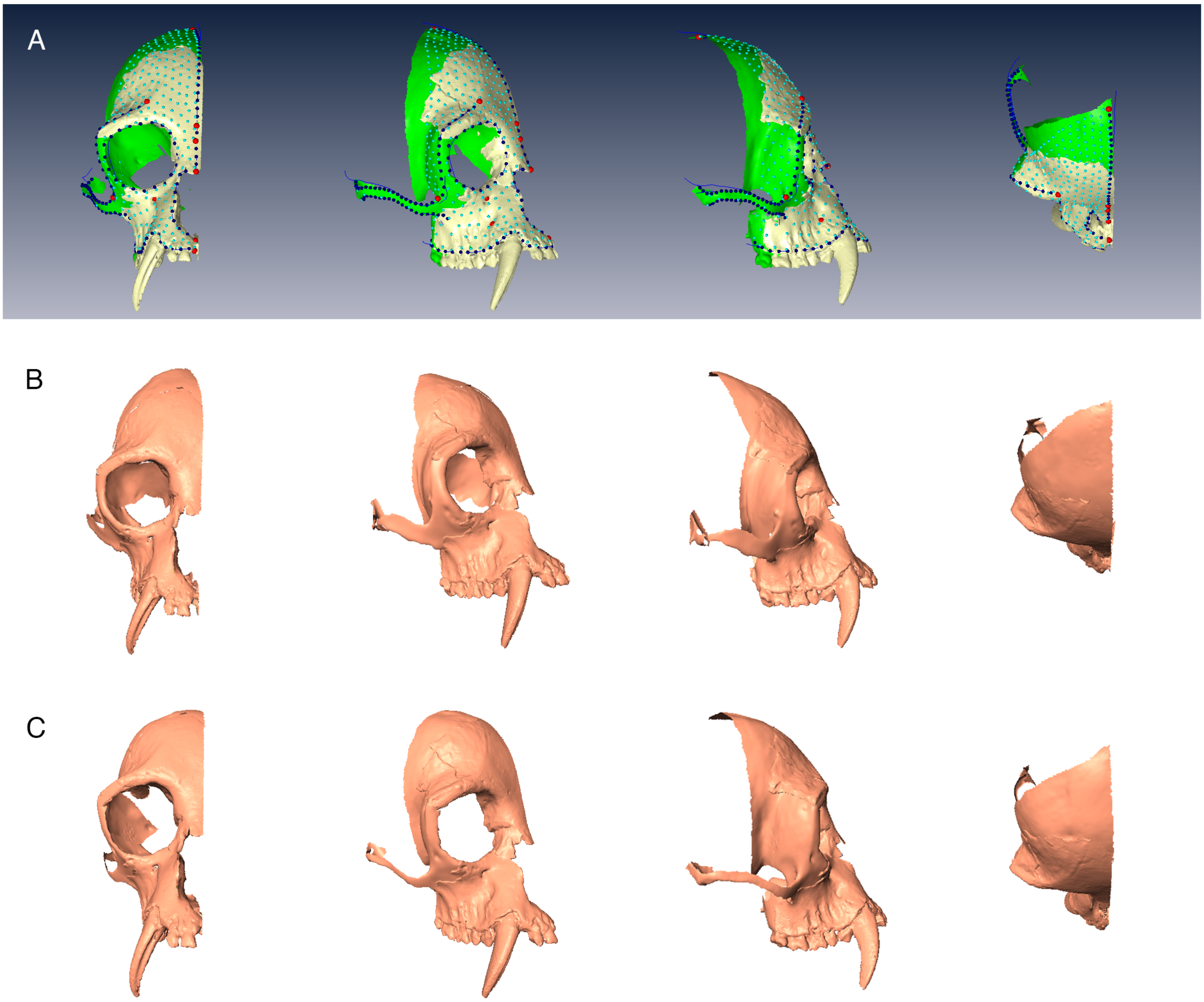

Figure S2. Reference-based reconstruction of M1K12:3. **A**, Reconstructing M1K12:3 using *Nomascus concolor* reference cranium, showing three-dimensional visualisation of M1K12:3 cranium (partially restored through mirror-imaging) in pale yellow, reconstructed areas in green, landmarks in red, curve semi-landmarks in dark blue, and surface semi-landmarks in light blue. **B**, Partially restored cranium of M1K12:3 based on *Hylobates lar* reference cranium. **C**, Partially restored cranium of M1K12:3 based on *Nomascus concolor* reference cranium.

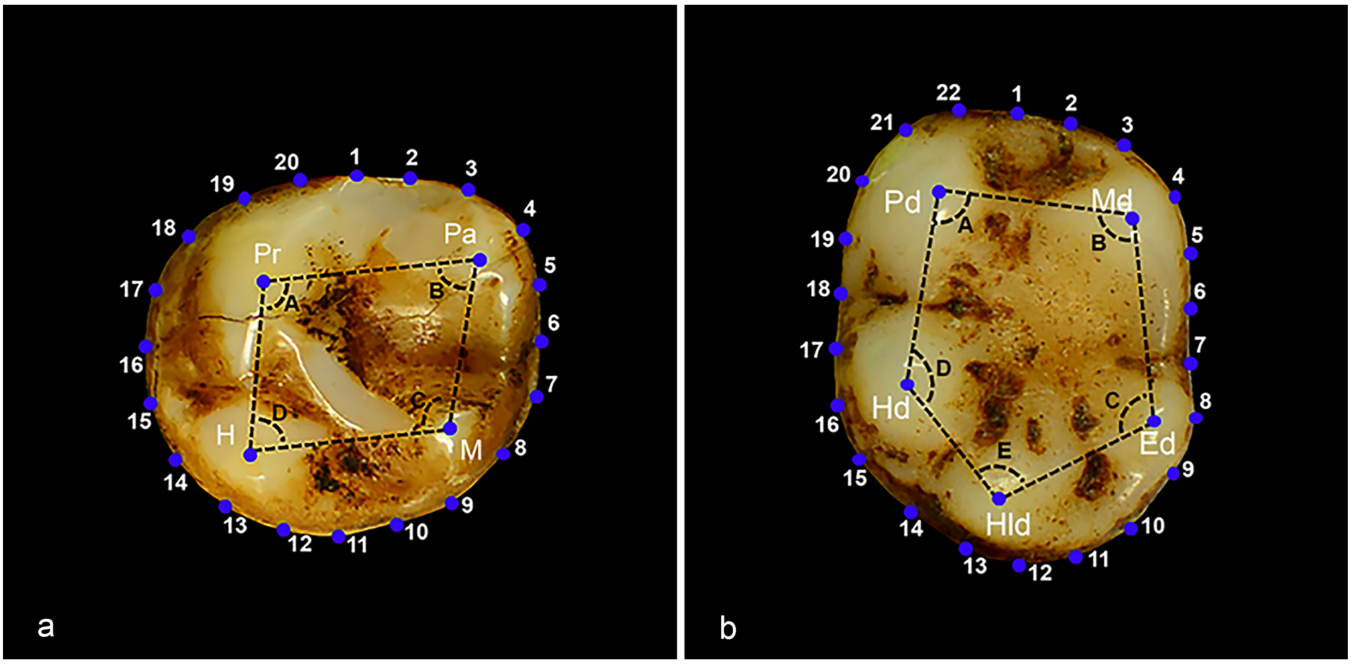

Figure S3. Landmarks and semi-landmarks used in comparative analysis of upper and lower molars. **a**, Upper molars: Pr, protocone (angle A); Pa, paracone (angle B); M, metacone (angle C); H, hypocone (angle D). **b**, Lower molars: Pd, protoconid (angle A); Md, metaconid (angle B); Ed, entoconid (angle C); Hd, hypoconid (angle D); Hld, hypoconulid (angle E).

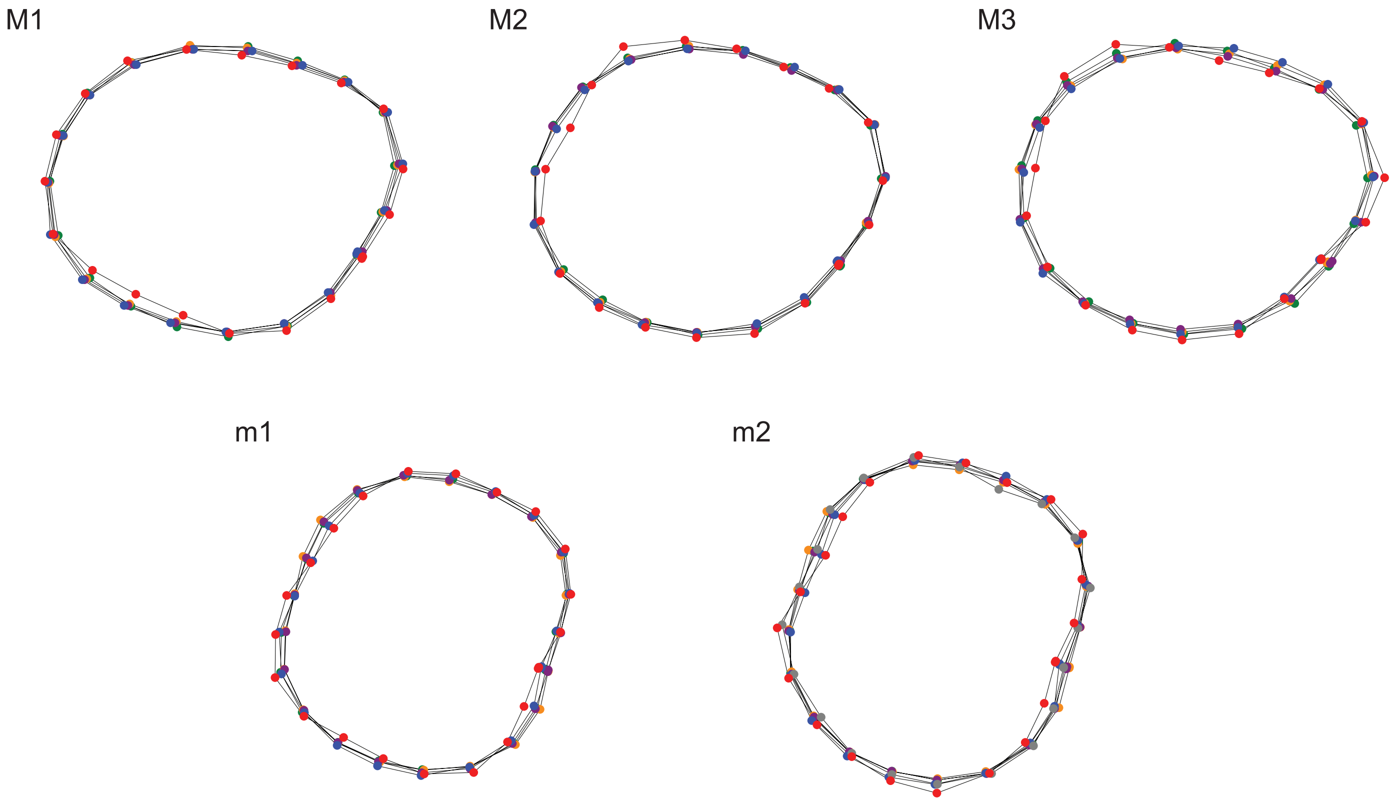

Figure S4. Comparisons of molar crown variation between M1K12:3, *Bunopithecus*, and extant hylobatids based on mean shape outlines. Outlines are of left molars; for M1-M3 the lingual surface is located to the left, and for m1-m2 the lingual surface is located to the right in each image. Key: M1K12:3, red; *Bunopithecus*, gray (m2 only); *Hoolock*, green; *Hylobates*, orange; *Nomascus*, purple; *Symphalangus*, blue.

Table S2. Variance and eigenvalues for cranial and molar CVAs. Data for first three axes provided.

CVA results	Cranium	M1	M2	M3	m1	m2
Axis 1, % variance	60.90	36.58	46.77	43.33	43.67	41.89
Axis 1, Eigenvalue	4.92	1.35	1.11	1.80	2.04	1.85
Axis 2, % variance	23.03	32.19	21.70	29.03	29.37	24.83
Axis 2, Eigenvalue	1.86	1.19	0.51	1.21	1.37	1.09
Axis 3, % variance	10.44	21.26	20.44	16.78	15.82	17.92
Axis 3, Eigenvalue	0.84	0.79	0.48	0.70	0.74	0.79

Table S3. Cross-validation results for cranial and molar CVAs. Main value = not jackknifed; value in parentheses = jackknifed.

A. Cranium

	Hoolock	*Hylobates*	*Nomascus*	*Junzi*	*Symphalangus*	Total	
Hoolock	52 (50)	1 (3)	0 (0)	0 (0)	0 (0)	53	**Not jackknifed:** 97.5% correctly classified
Hylobates	3 (5)	319 (314)	5 (8)	0 (0)	0 (0)	327	
Nomascus	0 (0)	0 (0)	34 (34)	0 (0)	0 (0)	34	
Junzi	0 (0)	0 (0)	0 (0)	2 (2)	0 (0)	2	
Symphalangus	3 (3)	0 (0)	0 (0)	0 (0)	60 (60)	63	**Jackknifed:** 96.0% correctly classified
Total	58 (58)	320 (317)	39 (42)	2 (2)	60 (60)	479	

B. M1

	Hylobates	*Symphalangus*	*Hoolock*	*Nomascus*	*Junzi*	Total	
Hylobates	58 (42)	0 (3)	6 (10)	1 (8)	0 (2)	65	**Not jackknifed:** 86.3% correctly classified
Symphalangus	1 (1)	9 (6)	0 (3)	1 (1)	0 (0)	11	
Hoolock	3 (7)	1 (2)	35 (28)	2 (4)	0 (0)	41	
Nomascus	4 (10)	0 (1)	1 (4)	23 (13)	0 (0)	28	
Junzi	0 (1)	0 (0)	0 (0)	0 (0)	1 (0)	1	**Jackknifed:** 61.0% correctly classified
Total	66 (61)	10 (12)	42 (45)	27 (26)	1 (2)	146	

C. M2

	Hylobates	*Symphalangus*	*Hoolock*	*Nomascus*	*Junzi*	Total	
Hylobates	72 (53)	5 (9)	14 (23)	7 (12)	0 (1)	98	**Not jackknifed:** 76.3% correctly classified
Symphalangus	0 (3)	15 (10)	3 (4)	0 (1)	0 (0)	18	
Hoolock	5 (11)	5 (7)	41 (27)	0 (5)	0 (1)	51	
Nomascus	6 (7)	0 (2)	2 (4)	22 (17)	0 (0)	30	
Junzi	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1	**Jackknifed:** 54.6% correctly classified
Total	83 (74)	25 (28)	60 (58)	29 (35)	1 (3)	198	

D. M3

	Symphalangus	*Hylobates*	*Hoolock*	*Nomascus*	*Junzi*	Total	
Symphalangus	12 (7)	0 (2)	0 (1)	0 (2)	0 (0)	12	**Not jackknifed:** 80.7% correctly classified
Hylobates	1 (7)	53 (42)	12 (16)	3 (4)	0 (0)	69	
Hoolock	0 (0)	3 (6)	27 (20)	1 (5)	0 (0)	31	
Nomascus	3 (3)	2 (4)	2 (6)	20 (14)	0 (0)	27	
Junzi	0 (0)	0 (0)	0 (0)	0 (1)	1 (0)	1	**Jackknifed:** 59.3% correctly classified
Total	16 (17)	58 (54)	41 (43)	24 (26)	1 (0)	140	

E. m1

	Hylobates	*Symphalangus*	*Hoolock*	*Nomascus*	*Junzi*	Total	
Hylobates	49 (37)	2 (6)	8 (13)	3 (6)	0 (0)	62	**Not jackknifed:** 84.4% correctly classified
Symphalangus	0 (3)	10 (2)	0 (3)	0 (2)	0 (0)	10	
Hoolock	3 (7)	0 (2)	27 (17)	0 (4)	0 (0)	30	
Nomascus	2 (6)	0 (3)	1 (3)	16 (6)	0 (1)	19	
Junzi	0 (0)	0 (1)	0 (0)	0 (0)	1 (0)	1	**Jackknifed:** 50.8% correctly classified
Total	54 (53)	12 (14)	36 (36)	19 (18)	1 (1)	122	

F. m2

	Symphalangus	*Hylobates*	*Hoolock*	*Nomascus*	*Bunopithecus*	*Junzi*	Total	
Symphalangus	22 (15)	0 (4)	0 (2)	0 (1)	0 (0)	0 (0)	22	**Not jackknifed:** 84.7% correctly classified
Hylobates	1 (3)	84 (71)	12 (20)	3 (6)	0 (0)	0 (0)	100	
Hoolock	0 (1)	2 (10)	39 (26)	3 (6)	0 (1)	0 (0)	44	
Nomascus	0 (2)	4 (4)	4 (8)	13 (6)	0 (1)	0 (0)	21	
Bunopithecus	0 (0)	0 (0)	0 (1)	0 (0)	1 (0)	0 (0)	1	**Jackknifed:** 62.4% correctly classified
Junzi	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	1	
Total	23 (22)	90 (89)	55 (57)	19 (19)	1 (2)	1 (0)	189	

Table S5. Significance of comparisons between extant hylobatid genera for permutation tests (10,000 permutation rounds) of molar Procrustes distances. Non-significant differences in red.

	Hoolock	*Hylobates*	*Nomascus*
M1			
Hylobates	0.0006		
Nomascus	<.0001	0.0025	
Symphalangus	<.0001	<.0001	0.0104
M2			
Hylobates	<.0001		
Nomascus	<.0001	0.1698	
Symphalangus	<.0001	0.0901	0.0458
M3			
Hylobates	<.0001		
Nomascus	<.0001	0.0031	
Symphalangus	<.0001	0.0064	<.0001
m1			
Hylobates	<.0001		
Nomascus	0.0422	0.0678	
Symphalangus	0.0079	<.0001	0.0346
m2			
Hylobates	<.0001		
Nomascus	0.2157	0.0006	
Symphalangus	<.0001	<.0001	0.0001

Table S6. Linear dimensions of upper and lower molars of *Junzi imperialis* compared with extant hylobatids (in mm). Extant hylobatid data from refs 42-44.

		Junzi imperialis	*Nomascus concolor*	*Nomascus leucogenys*	*Hoolock hoolock*	*Symphalangus syndactylus*	*Hylobates agilis*	*Hylobates lar*	*Hylobates moloch*	*Hylobates klossii*
M1	N	1	8	6	17	36	16	26	11	8
	Mediodistal mean (range)	7.02	6.1 (5.9-6.4)	6.3 (5.9-6.6)	6.7 (6.1-7.2)	7.6 (6.0-8.3)	5.9 (5.5-6.7)	5.7 (5.3-6.2)	5.7 (4.7-6.6)	5.4 (5.0-5.6)
	Buccolingual mean (range)	7.17	6.8 (6.5-7.3)	6.7 (6.2-7.1)	7.0 (6.6-7.7)	7.2 (6.2-8.3)	6.3 (5.7-6.7)	6.2 (5.8-7.0)	6.3 (5.7-6.8)	5.9 (5.4-6.3
M2	N	1	10	10	17	36	17	25	10	8
	Mediodistal mean (range)	7.98	6.7 (5.7-7.2)	6.7 (6.2-7.1)	7.1 (6.7-7.5)	8.1 (6.9-9.0)	6.0 (5.7-6.5)	6.1 (5.2-6.7)	6.3 (5.9-7.3)	5.4 (5.0-5.8)
	Buccolingual mean (range)	7.81	7.1 (6.5-7.7)	7.4 (6.7-7.9)	7.7 (7.0-8.1)	8.0 (6.9-8.8)	6.4 (5.8-6.8)	6.5 (6.1-7.0)	6.5 (5.7-7,2)	5.9 (5.4-6.3)
M3	N	1	7	3	13	26	17	24	9	8
	Mediodistal mean (range)	7.1	6.3 (5.6-6.8)	5.9 (5.2-6.7)	6.4 (5.3-7.0)	7.2 (5-5-8.4)	5.4 (4.9-6.0)	5.3 (4.7-6.2)	5.3 (4.7-5.9)	4.0 (3.3-4.5)
	Buccolingual mean (range)	7.8	7.1 (6.5-7.7)	7.1 (6.4-7.5)	7.3 (6.3-8.1)	7.7 (7.1-9.1)	6.1 (5.2-6.9)	6.1 (5.2-6.8)	6.2 (5.4-7.0)	5.6 (5.4-6.0)
m1	N	1	7	4	16	30	16	25	11	9
	Mediodistal mean (range)	6.45	6.8 (6.5-7.2)	7.1 (6.7-7.5)	6.8 (6.5-7.3)	8.0 (6.9-8.7)	6.3 (5.6-6.8)	6.0 (5.7-6.5)	6.3 (5.7-7.2)	5.9 (5.7-6.1)
	Buccolingual mean (range)	5.85	5.3 (5.0-5.7)	5.4 (5.2-5.7)	5.6 (5.0-6.2)	6.3 (5.4-6.9)	5.2 (5.6-6.8)	5.1 (4.6-5.7)	5.0 4.4-5.8)	4.8 (4.2-5.8)
m2	N	1	9	6	16	30	17	23	10	8
	Mediodistal mean (range)	8.48	7.2 (6.9-7.6)	7.2 (6.3-7.9)	7.6 (7.3-8.5)	8.7 (7.5-9.8)	6.3 (5.9-6.9)	6.2 (5.4-6.6)	6.5 (5.7-7.3)	6.0 (5.5-6.6)
	Buccolingual mean (range)	6.43	5.8 (5.4-6.3)	6.0 (5.5-6.6)	6.6 (5.9-7.5)	6.9 (6.1-7.5)	5.6 (5.2-6.4)	5.4 (4.9-6.0)	5.6 (4.9-6.3)	5.1 (4.8-5.2)

Table S7. Descriptive statistics for molar cusp angles and polygon and occlusal areas in M1K12:3 and extant hylobatid genera.

Features	M1K12:3	*Hoolock*			*Hylobates*			*Nomascus*			*Symphalangus*		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
M1 ANPARA	1.964	26	1.84	0.08	36	1.77	0.16	7	1.79	0.26	5	1.88	0.07
M1 OCCLAREA	33.226	6	39.62	5.85	19	31.84	3.56	24	34.24	3.41	7	**<u>49.62</u>**	**<u>7.84</u>**
M2 APOL	0.336	36	0.36	0.03	73	0.37	0.04	6	0.33	0.02	15	0.34	0.04
M2 ANPROTO	1.307	35	1.33	0.11	69	1.41	0.38	8	1.67	0.78	12	1.31	0.08
M2 ANPARA	1.886	35	1.83	0.09	71	1.82	0.17	8	1.70	0.46	13	1.89	0.09
M2 ANMETA	1.352	36	1.30	0.11	74	1.31	0.16	10	1.33	0.33	13	1.26	0.09
M2 ANHYPO	1.738	33	1.81	0.09	67	1.85	0.26	8	1.77	0.69	13	1.83	0.09
M2 OCCLAREA	44.313	14	44.97	5.83	36	**<u>34.21</u>**	**<u>3.77</u>**	27	40.24	4.07	7	57.82	6.87
M3 APOL	0.330	14	0.36	0.03	18	0.36	0.03	6	0.36	0.04	6	0.39	0.05
M3 ANPROTO	1.086	17	1.70	0.53	34	1.95	0.62	7	1.38	0.19	7	1.65	0.62
M3 ANPARA	2.168	16	1.68	0.47	40	1.81	0.51	8	**<u>1.95</u>**	**<u>0.10</u>**	6	1.93	0.13
M3 ANMETA	1.133	18	1.39	0.31	37	1.59	0.56	9	1.20	0.10	6	1.43	0.46
M3 ANHYPO	1.895	16	1.72	0.37	34	1.93	0.62	7	1.77	0.10	6	1.90	0.53
M3 OCCLAREA	43.373	8	39.26	3.39	28	**<u>26.94</u>**	**<u>4.18</u>**	25	36.01	4.40	9	46.91	6.54
m1 APOL	0.362	21	0.37	0.02	39	0.39	0.04	8	0.37	0.03	5	0.37	0.01
m1 ANPROT	1.416	20	1.52	0.09	47	1.58	0.14	9	**<u>1.64</u>**	**<u>0.04</u>**	5	**<u>1.58</u>**	**<u>0.05</u>**
m1 ANMET	1.322	20	**<u>1.45</u>**	**<u>0.05</u>**	44	1.47	0.15	9	1.37	0.06	5	1.41	0.06
m1 OCCLAREA	31.307	20	32.90	4.21	48	28.36	4.00	19	30.37	3.86	8	**<u>44.70</u>**	**<u>4.18</u>**
m2 APOL	0.355	31	0.36	0.03	85	0.37	0.03	8	0.35	0.02	17	0.35	0.02
m2 ANPROT	1.479	32	**<u>1.62</u>**	**<u>0.06</u>**	89	1.57	0.08	8	1.58	0.06	17	1.60	0.06
m2 ANMET	1.246	32	1.40	0.09	89	**<u>1.47</u>**	**<u>0.08</u>**	9	**<u>1.43</u>**	**<u>0.08</u>**	18	1.34	0.14
m2 ANHYP	1.247	32	1.24	0.08	83	1.28	0.13	8	1.26	0.06	18	1.30	0.14
m2 ANENTO	0.999	31	0.82	0.11	83	0.79	0.11	8	0.85	0.09	18	**<u>0.71</u>**	**<u>0.12</u>**
m2 ANHYPLID	1.312	32	1.22	0.11	82	1.17	0.14	8	1.17	0.09	18	1.32	0.10
m2 OCCLAREA	40.933	29	43.82	3.94	89	**<u>30.94</u>**	**<u>4.23</u>**	21	35.21	5.57	22	**<u>54.62</u>**	**<u>5.45</u>**

ANENTO: angle entoconid: ANHYP: angle hypoconid; ANHYPLID: angle hypoconulid; ANHYPO: angle hypocone; ANMET: angle metaconid; ANMETA: angle metacone; ANPARA: angle paracone; ANPROT: angle protoconid; ANPROTO: angle protocone; APOL: ratio polygon area/crown area; OCCLAREA: total occlusal area in mm^2. Angles in radians. Bold/underlined values indicate significant differences with M1K12:3 based on 95% confidence intervals (±2 SD). *Bunopithecus sericus* M2 OCCLAREA: 39.79 mm^2 (Ortiz et al. 2015).

Table S1. Cranial and molar Procrustes and Mahalanobis distances between M1K12:3, *E*

CRANIUM

Mahalanobis distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangus*
Hylobates	4.3368			
Nomascus	4.7009	4.5591		
Symphalangus	5.4607	6.467	7.1752	
M1K12:3	12.3394	13.4255	11.7389	13.6552

M1

Mahalanobis distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangus*
Hylobates	2.4141			
Nomascus	3.3487	2.8522		
Symphalangus	4.0065	4.1051	4.0908	
M1K12:3	7.7463	7.333	7.6757	8.5952

M2

Mahalanobis distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangus*
Hylobates	1.8286			
Nomascus	3.2851	2.6164		
Symphalangus	2.718	2.6255	3.7378	
M1K12:3	7.2878	7.2019	7.63	7.3878

M3

Mahalanobis distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangus*
Hylobates	2.2413			
Nomascus	3.2792	3.2025		
Symphalangus	4.5069	3.9717	4.2337	
M1K12:3	10.1874	10.004	9.0272	9.0861

m1

Mahalanobis distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangus*
Hylobates	2.7457			

Nomascus	3.7097	3.3184		
Symphalangus	3.5873	3.9641	4.067	
M1K12:3	10.8271	11.6648	10.4398	10.1538

m2

Mahalanobis distances among groups:

	Bunopithecus	*Hoolock*	*Hylobates*	*Nomascus*	*Symphalangu*
Hoolock	8.6494				
Hylobates	8.9645	2.2832			
Nomascus	9.0183	2.3106	2.8501		
Symphalangus	9.6127	4.1005	4.021	4.4259	
M1K12:3	12.5767	13.2441	13.0125	13.136	11.9052

3unopithecus , and extant hylobatids.

Procrustes distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangu*
Hylobates	0.0488			
Nomascus	0.0661	0.0535		
Symphalangus	0.0714	0.0943	0.099	
M1K12:3	0.1389	0.1482	0.1294	0.1412

Procrustes distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangu*
Hylobates	0.0164			
Nomascus	0.0256	0.0182		
Symphalangus	0.0391	0.0356	0.0284	
M1K12:3	0.0463	0.04	0.0431	0.0652

Procrustes distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangu*
Hylobates	0.0182			
Nomascus	0.0231	0.0119		
Symphalangus	0.0277	0.0163	0.0184	
M1K12:3	0.0449	0.049	0.0517	0.0523

Procrustes distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangu*
Hylobates	0.0319			
Nomascus	0.0329	0.0221		
Symphalangus	0.0482	0.0287	0.0399	
M1K12:3	0.0562	0.06	0.0562	0.0634

Procrustes distances among groups:

	Hoolock	*Hylobates*	*Nomascus*	*Symphalangu*
Hylobates	0.0218			

Nomascus	0.0197	0.0159		
Symphalangus	0.0249	0.04	0.0317	
M1K12:3	0.0449	0.0616	0.0522	0.0369

Procrustes distances among groups:

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	Bunopithecus	*Hoolock*	*Hylobates*	*Nomascus*
Hoolock	0.0293			
Hylobates	0.0348	0.0166		
Nomascus	0.0301	0.0113	0.0203	
Symphalangus	0.0427	0.029	0.0415	0.0285
M1K12:3	0.0561	0.059	0.0693	0.0569

'S

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'S

'S

'S

Symphalangus

0.0419

ID	Specimen	Tooth type	Sex	Genus	Species
1. Upper dentition					
1	AMNH 102026	M2	Female	*Hylobates*	*moloch*
2	AMNH 102093	M2	Male	*Symphalangus*	*syndactylus*
3	AMNH 102161	M1	Male	*Hylobates*	*agilis*
4	AMNH 102161	M2	Male	*Hylobates*	*agilis*
5	AMNH 102162	M1	Male	*Hylobates*	*agilis*
6	AMNH 102162	M2	Male	*Hylobates*	*agilis*
7	AMNH 102186	M2	Female	*Symphalangus*	*syndactylus*
8	AMNH 102189	M1	Male	*Symphalangus*	*syndactylus*
9	AMNH 102193	M1	Male	*Symphalangus*	*syndactylus*
10	AMNH 102193	M2	Male	*Symphalangus*	*syndactylus*
11	AMNH 102195	M2	Female	*Symphalangus*	*syndactylus*
12	AMNH 102195	M3	Female	*Symphalangus*	*syndactylus*
13	AMNH 102197	M2	Female	*Symphalangus*	*syndactylus*
14	AMNH 102198	M1	Female	*Hylobates*	*agilis*
15	AMNH 102198	M2	Female	*Hylobates*	*agilis*
16	AMNH 102199	M2	Male	*Hylobates*	*agilis*
17	AMNH 102199	M3	Male	*Hylobates*	*agilis*
18	AMNH 102200	M1	Female	*Hylobates*	*agilis*
19	AMNH 102200	M2	Female	*Hylobates*	*agilis*
20	AMNH 102200	M3	Female	*Hylobates*	*agilis*
21	AMNH 102470	M3	Male	*Hylobates*	*agilis*
22	AMNH 102471	M1	Female	*Hylobates*	*agilis*
23	AMNH 102471	M2	Female	*Hylobates*	*agilis*
24	AMNH 102472	M2	Male	*Hylobates*	*agilis*
25	AMNH 102473	M1	Female	*Hylobates*	*agilis*
26	AMNH 102474	M1	Female	*Hylobates*	*agilis*
27	AMNH 102721	M2	Female	*Symphalangus*	*syndactylus*
28	AMNH 102727	M2	Female	*Symphalangus*	*syndactylus*
29	AMNH 102727	M3	Female	*Symphalangus*	*syndactylus*
30	AMNH 102729	M1	Male	*Symphalangus*	*syndactylus*
31	AMNH 102729	M2	Male	*Symphalangus*	*syndactylus*
32	AMNH 102773	M2	Female	*Hylobates*	*agilis*
33	AMNH 102773	M3	Female	*Hylobates*	*agilis*
34	AMNH 102774	M1	Male	*Hylobates*	*agilis*
35	AMNH 102774	M2	Male	*Hylobates*	*agilis*
36	AMNH 102774	M3	Male	*Hylobates*	*agilis*
37	AMNH 102775	M1	Male	*Hylobates*	*agilis*
38	AMNH 102775	M2	Male	*Hylobates*	*agilis*
39	AMNH 102776	M1	Female	*Hylobates*	*agilis*
40	AMNH 102776	M2	Female	*Hylobates*	*agilis*
41	AMNH 102776	M3	Female	*Hylobates*	*agilis*
42	AMNH 102777	M1	Female	*Hylobates*	*agilis*

43	AMNH 102779	M1	Male	*Hylobates*	*agilis*
44	AMNH 102779	M2	Male	*Hylobates*	*agilis*
45	AMNH 102780	M1	Male	*Hylobates*	*agilis*
46	AMNH 102780	M2	Male	*Hylobates*	*agilis*
47	AMNH 103243	M2	Male	*Hylobates*	*klossii*
48	AMNH 103244	M2	Female	*Hylobates*	*klossii*
49	AMNH 103246	M2	Female	*Hylobates*	*klossii*
50	AMNH 103246	M3	Female	*Hylobates*	*klossii*
51	AMNH 103247	M2	Male	*Hylobates*	*klossii*
52	AMNH 103247	M3	Male	*Hylobates*	*klossii*
53	AMNH 103250	M2	Male	*Hylobates*	*klossii*
54	AMNH 103250	M3	Male	*Hylobates*	*klossii*
55	AMNH 103252	M2	Female	*Hylobates*	*klossii*
56	AMNH 103252	M3	Female	*Hylobates*	*klossii*
57	AMNH 103345	M3	Male	*Hylobates*	*klossii*
58	AMNH 103346	M1	Male	*Hylobates*	*klossii*
59	AMNH 103346	M2	Male	*Hylobates*	*klossii*
60	AMNH 103346	M3	Male	*Hylobates*	*klossii*
61	AMNH 103351	M1	Female	*Hylobates*	*klossii*
62	AMNH 103351	M2	Female	*Hylobates*	*klossii*
63	AMNH 103351	M3	Female	*Hylobates*	*klossii*
64	AMNH 103352	M1	Male	*Hylobates*	*klossii*
65	AMNH 103352	M2	Male	*Hylobates*	*klossii*
66	AMNH 103352	M3	Male	*Hylobates*	*klossii*
67	AMNH 103353	M2	Male	*Hylobates*	*klossii*
68	AMNH 103403	M3	Female	*Hylobates*	*muelleri*
69	AMNH 103441	M1	Male	*Hylobates*	*moloch*
70	AMNH 103441	M2	Male	*Hylobates*	*moloch*
71	AMNH 103441	M3	Male	*Hylobates*	*moloch*
72	AMNH 103442	M2	Female	*Hylobates*	*moloch*
73	AMNH 103442	M3	Female	*Hylobates*	*moloch*
74	AMNH 103443	M2	Female	*Hylobates*	*moloch*
75	AMNH 103443	M3	Female	*Hylobates*	*moloch*
76	AMNH 103444	M1	Female	*Hylobates*	*moloch*
77	AMNH 103444	M2	Female	*Hylobates*	*moloch*
78	AMNH 103445	M3	Female	*Hylobates*	*moloch*
79	AMNH 103446	M2	Male	*Hylobates*	*klossii*
80	AMNH 103448	M1	Female	*Hylobates*	*moloch*
81	AMNH 103448	M2	Female	*Hylobates*	*moloch*
82	AMNH 103448	M3	Female	*Hylobates*	*moloch*
83	AMNH 103449	M2	Female	*Hylobates*	*moloch*
84	AMNH 103449	M3	Female	*Hylobates*	*moloch*
85	AMNH 103451	M3	Female	*Hylobates*	*klossii*
86	AMNH 103452	M1	Female	*Hylobates*	*moloch*

87	AMNH 103452	M3	Female	*Hylobates*	*moloch*
88	AMNH 103454	M1	Male	*Hylobates*	*moloch*
89	AMNH 103454	M2	Male	*Hylobates*	*moloch*
90	AMNH 103454	M3	Male	*Hylobates*	*moloch*
91	AMNH 103665	M3	Female	*Hylobates*	*agilis*
92	AMNH 103723	M2	Male	*Hylobates*	*moloch*
93	AMNH 103723	M3	Male	*Hylobates*	*moloch*
94	AMNH 103725	M1	Female	*Hylobates*	*moloch*
95	AMNH 103726	M1	Male	*Hylobates*	*moloch*
96	AMNH 103726	M2	Male	*Hylobates*	*moloch*
97	AMNH 106053	M2	Male	*Hylobates*	*agilis*
98	AMNH 106053	M3	Male	*Hylobates*	*agilis*
99	AMNH 106322	M2	Male	*Hylobates*	*moloch*
100	AMNH 106326	M3	Female	*Hylobates*	*moloch*
101	AMNH 106327	M1	Female	*Hylobates*	*moloch*
102	AMNH 106327	M2	Female	*Hylobates*	*moloch*
103	AMNH 106327	M3	Female	*Hylobates*	*moloch*
104	AMNH 106328	M1	Female	*Hylobates*	*moloch*
105	AMNH 106332	M1	Female	*Hylobates*	*moloch*
106	AMNH 106332	M2	Female	*Hylobates*	*moloch*
107	AMNH 106571	M1	Male	*Hylobates*	*agilis*
108	AMNH 106571	M2	Male	*Hylobates*	*agilis*
109	AMNH 106572	M1	Male	*Hylobates*	*agilis*
110	AMNH 106572	M2	Male	*Hylobates*	*agilis*
111	AMNH 106572	M3	Male	*Hylobates*	*agilis*
112	AMNH 106573	M3	Female	*Hylobates*	*agilis*
113	AMNH 106574	M1	Male	*Hylobates*	*agilis*
114	AMNH 106574	M2	Male	*Hylobates*	*agilis*
115	AMNH 106575	M2	Female	*Hylobates*	*agilis*
116	AMNH 106576	M2	Male	*Hylobates*	*agilis*
117	AMNH 106576	M3	Male	*Hylobates*	*agilis*
118	AMNH 106578	M2	Male	*Hylobates*	*agilis*
119	AMNH 106578	M3	Male	*Hylobates*	*agilis*
120	AMNH 106579	M1	Male	*Hylobates*	*agilis*
121	AMNH 106579	M2	Male	*Hylobates*	*agilis*
122	AMNH 106579	M3	Male	*Hylobates*	*agilis*
123	AMNH 106580	M2	Female	*Hylobates*	*agilis*
124	AMNH 106582	M3	Female	*Symphalangus*	*syndactylus*
125	AMNH 106583	M2	Female	*Symphalangus*	*syndactylus*
126	AMNH 106583	M3	Female	*Symphalangus*	*syndactylus*
127	AMNH 106675	M3	Male	*Hylobates*	*agilis*
128	AMNH 106676	M1	Male	*Hylobates*	*agilis*
129	AMNH 106676	M2	Male	*Hylobates*	*agilis*
130	AMNH 106677	M1	Female	*Hylobates*	*agilis*

131	AMNH 106677	M2	Female	*Hylobates*	*agilis*
132	AMNH 106678	M2	Female	*Hylobates*	*agilis*
133	AMNH 106679	M1	Female	*Hylobates*	*agilis*
134	AMNH 106679	M2	Female	*Hylobates*	*agilis*
135	AMNH 106679	M3	Female	*Hylobates*	*agilis*
136	AMNH 106779	M1	Male	*Hylobates*	*moloch*
137	AMNH 106779	M2	Male	*Hylobates*	*moloch*
138	AMNH 106779	M3	Male	*Hylobates*	*moloch*
139	AMNH 106781	M1	Female	*Hylobates*	*moloch*
140	AMNH 106781	M2	Female	*Hylobates*	*moloch*
141	AMNH 106781	M3	Female	*Hylobates*	*moloch*
142	AMNH 106782	M1	Female	*Hylobates*	*moloch*
143	AMNH 106782	M2	Female	*Hylobates*	*moloch*
144	AMNH 106782	M3	Female	*Hylobates*	*moloch*
145	AMNH 106783	M2	Female	*Hylobates*	*moloch*
146	AMNH 106783	M3	Female	*Hylobates*	*moloch*
147	AMNH 106788	M1	Female	*Hylobates*	*moloch*
148	AMNH 106788	M2	Female	*Hylobates*	*moloch*
149	AMNH 106788	M3	Female	*Hylobates*	*moloch*
150	AMNH 106789	M2	Male	*Hylobates*	*moloch*
151	AMNH 106789	M3	Male	*Hylobates*	*moloch*
152	AMNH 112667	M2	Female	*Hoolock*	*leuconedys*
153	AMNH 112667	M3	Female	*Hoolock*	*leuconedys*
154	AMNH 112668	M1	Male	*Hoolock*	*leuconedys*
155	AMNH 112668	M2	Male	*Hoolock*	*leuconedys*
156	AMNH 112669	M1	Female	*Hoolock*	*leuconedys*
157	AMNH 112670	M2	Female	*Hoolock*	*leuconedys*
158	AMNH 112671	M2	Male	*Hoolock*	*leuconedys*
159	AMNH 112674	M3	Female	*Hoolock*	sp.
160	AMNH 112677	M1	Female	*Hoolock*	*leuconedys*
161	AMNH 112677	M2	Female	*Hoolock*	*leuconedys*
162	AMNH 112679	M1	Female	*Hoolock*	*leuconedys*
163	AMNH 112679	M2	Female	*Hoolock*	*leuconedys*
164	AMNH 112679	M3	Female	*Hoolock*	*leuconedys*
165	AMNH 112680	M2	Female	*Hoolock*	*leuconedys*
166	AMNH 112681	M2	Male	*Hoolock*	*leuconedys*
167	AMNH 112681	M3	Male	*Hoolock*	*leuconedys*
168	AMNH 112683	M2	Male	*Hoolock*	*leuconedys*
169	AMNH 112685	M1	Male	*Hoolock*	*leuconedys*
170	AMNH 112685	M2	Male	*Hoolock*	*leuconedys*
171	AMNH 112686	M3	Female	*Hoolock*	*leuconedys*
172	AMNH 112687	M2	Female	*Hoolock*	*leuconedys*
173	AMNH 112688	M1	Female	*Hoolock*	*hoolock*
174	AMNH 112688	M2	Female	*Hoolock*	*hoolock*

175	AMNH 112688	M3	Female	*Hoolock*	*hoolock*
176	AMNH 112689	M1	Male	*Hoolock*	*hoolock*
177	AMNH 112690	M2	Female	*Hoolock*	*hoolock*
178	AMNH 112690	M3	Female	*Hoolock*	*hoolock*
179	AMNH 112691	M1	Male	*Hoolock*	*hoolock*
180	AMNH 112691	M2	Male	*Hoolock*	*hoolock*
181	AMNH 112692	M3	Male	*Hoolock*	*hoolock*
182	AMNH 112694	M2	Male	*Hoolock*	*hoolock*
183	AMNH 112694	M3	Male	*Hoolock*	*hoolock*
184	AMNH 112695	M1	Male	*Hoolock*	*hoolock*
185	AMNH 112696	M1	Male	*Hoolock*	*hoolock*
186	AMNH 112696	M3	Male	*Hoolock*	*hoolock*
187	AMNH 112697	M1	Female	*Hoolock*	*hoolock*
188	AMNH 112697	M2	Female	*Hoolock*	*hoolock*
189	AMNH 112697	M3	Female	*Hoolock*	*hoolock*
190	AMNH 112698	M2	Male	*Hoolock*	*hoolock*
191	AMNH 112698	M3	Male	*Hoolock*	*hoolock*
192	AMNH 112699	M1	Female	*Hoolock*	*hoolock*
193	AMNH 112700	M1	Male	*Hoolock*	*hoolock*
194	AMNH 112701	M2	Male	*Hoolock*	*hoolock*
195	AMNH 112701	M3	Male	*Hoolock*	*hoolock*
196	AMNH 112702	M2	Male	*Hoolock*	*hoolock*
197	AMNH 112703	M1	Male	*Hoolock*	*hoolock*
198	AMNH 112703	M2	Male	*Hoolock*	*hoolock*
199	AMNH 112703	M3	Male	*Hoolock*	*hoolock*
200	AMNH 112705	M3	Female	*Hoolock*	*hoolock*
201	AMNH 112710	M1	Male	*Hoolock*	*hoolock*
202	AMNH 112710	M2	Male	*Hoolock*	*hoolock*
203	AMNH 112711	M1	Female	*Hoolock*	*leuconedys*
204	AMNH 112711	M2	Female	*Hoolock*	*leuconedys*
205	AMNH 112711	M3	Female	*Hoolock*	*leuconedys*
206	AMNH 112713	M1	Male	*Hoolock*	*leuconedys*
207	AMNH 112713	M2	Male	*Hoolock*	*leuconedys*
208	AMNH 112713	M3	Male	*Hoolock*	*leuconedys*
209	AMNH 112716	M2	Male	*Hoolock*	*leuconedys*
210	AMNH 112716	M3	Male	*Hoolock*	*leuconedys*
211	AMNH 112717	M1	Female	*Hoolock*	*leuconedys*
212	AMNH 112717	M2	Female	*Hoolock*	*leuconedys*
213	AMNH 112721	M1	Female	*Hoolock*	sp.
214	AMNH 112721	M2	Female	*Hoolock*	sp.
215	AMNH 112960	M1	Male	*Hoolock*	*leuconedys*
216	AMNH 112962	M1	Female	*Hoolock*	*leuconedys*
217	AMNH 112962	M2	Female	*Hoolock*	*leuconedys*
218	AMNH 112965	M1	Female	*Hoolock*	*leuconedys*

219	AMNH 114546	M2	Female	*Hoolock*	sp.
220	AMNH 119601	M1	Unknown	*Hylobates*	*lar*
221	AMNH 119601	M2	Unknown	*Hylobates*	*lar*
222	AMNH 119602	M1	Unknown	*Hylobates*	*agilis*
223	AMNH 119602	M2	Unknown	*Hylobates*	*agilis*
224	AMNH 119624	M1	Unknown	*Hoolock*	sp.
225	AMNH 119624	M2	Unknown	*Hoolock*	sp.
226	AMNH 130172	M1	Unknown	*Hylobates*	*moloch*
227	AMNH 130172	M2	Unknown	*Hylobates*	*moloch*
228	AMNH 163630	M1	Male	*Hoolock*	*hoolock*
229	AMNH 163630	M2	Male	*Hoolock*	*hoolock*
230	AMNH 163630	M3	Male	*Hoolock*	*hoolock*
231	AMNH 163631	M1	Male	*Hoolock*	sp.
232	AMNH 163632	M3	Male	*Hoolock*	*hoolock*
233	AMNH 200752	M1	Female	*Hylobates*	*lar*
234	AMNH 200752	M2	Female	*Hylobates*	*lar*
235	AMNH 200752	M3	Female	*Hylobates*	*lar*
236	AMNH 200853	M1	Female	*Hylobates*	*moloch*
237	AMNH 200853	M2	Female	*Hylobates*	*moloch*
238	AMNH 202384	M2	Male	*Hylobates*	*lar*
239	AMNH 32636	M1	Male	*Hylobates*	*muelleri*
240	AMNH 32636	M2	Male	*Hylobates*	*muelleri*
241	AMNH 32636	M3	Male	*Hylobates*	*muelleri*
242	AMNH 43063	M1	Female	*Hoolock*	sp.
243	AMNH 43063	M2	Female	*Hoolock*	sp.
244	AMNH 43064	M2	Female	*Hoolock*	sp.
245	AMNH 54659	M1	Female	*Hylobates*	*lar*
246	AMNH 54659	M2	Female	*Hylobates*	*lar*
247	AMNH 54659	M3	Female	*Hylobates*	*lar*
248	AMNH 54662	M1	Female	*Hylobates*	*lar*
249	AMNH 54662	M2	Female	*Hylobates*	*lar*
250	AMNH 54662	M3	Female	*Hylobates*	*lar*
251	AMNH 54966	M1	Male	*Hylobates*	*lar*
252	AMNH 54966	M2	Male	*Hylobates*	*lar*
253	AMNH 54966	M3	Male	*Hylobates*	*lar*
254	AMNH 83413	M1	Male	*Hoolock*	*hoolock*
255	AMNH 83413	M2	Male	*Hoolock*	*hoolock*
256	AMNH 83413	M3	Male	*Hoolock*	*hoolock*
257	AMNH 83414	M1	Male	*Hoolock*	*hoolock*
258	AMNH 83414	M2	Male	*Hoolock*	*hoolock*
259	AMNH 83415	M1	Male	*Hoolock*	*hoolock*
260	AMNH 83415	M2	Male	*Hoolock*	*hoolock*
261	AMNH 83415	M3	Male	*Hoolock*	*hoolock*
262	AMNH 83417	M1	Male	*Hoolock*	*hoolock*

263	AMNH 83417	M2	Male	*Hoolock*	*hoolock*
264	AMNH 83418	M1	Female	*Hoolock*	*hoolock*
265	AMNH 83418	M2	Female	*Hoolock*	*hoolock*
266	AMNH 83422	M2	Male	*Hoolock*	*hoolock*
267	AMNH 83423	M1	Female	*Hoolock*	*hoolock*
268	AMNH 83427	M1	Male	*Hoolock*	*hoolock*
269	AMNH 83427	M2	Male	*Hoolock*	*hoolock*
270	AMNH 87251	M1	Male	*Nomascus*	*concolor*
271	AMNH 87251	M2	Male	*Nomascus*	*concolor*
272	AMNH 87252	M1	Male	*Nomascus*	*concolor*
273	AMNH 87252	M2	Male	*Nomascus*	*concolor*
274	AMNH 87252	M3	Male	*Nomascus*	*concolor*
275	AMNH 179	M1	Unknown	*Hoolock*	sp.
276	AMNH 19400	M1	Unknown	*Hoolock*	sp.
277	AMNH 35613	M1	Male	*Symphalangus*	*syndactylus*
278	AMNH 35613	M2	Male	*Symphalangus*	*syndactylus*
279	AMNH 41342	M2	Unknown	*Hylobates*	*moloch*
280	AMNH 80068	M2	Female	*Hoolock*	sp.
281	AMNH 80068	M3	Female	*Hoolock*	sp.
282	AMNH 90268	M2	Female	*Symphalangus*	*syndactylus*
283	AMNH 99340	M1	Female	*Hoolock*	sp.
284	IOZ 25965	M2	Unknown	*Hoolock*	*tianxing*
285	IOZ 25965	M3	Unknown	*Hoolock*	*tianxing*
286	IOZ 14517 / 80570	M1	Unknown	*Nomascus*	*leucogenys*
287	IOZ 14517 / 80570	M2	Unknown	*Nomascus*	*leucogenys*
288	IOZ 14517 / 80570	M3	Unknown	*Nomascus*	*leucogenys*
289	IOZ 17940	M1	Male	*Nomascus*	*concolor*
290	IOZ 17940	M2	Male	*Nomascus*	*concolor*
291	IOZ 17940	M3	Male	*Nomascus*	*concolor*
292	IOZ 19552	M2	Unknown	*Nomascus*	*leucogenys*
293	SCIEA 0088	M1	Female	*Nomascus*	*hainanus*
294	SCIEA 0088	M2	Female	*Nomascus*	*hainanus*
295	SCIEA 0088	M3	Female	*Nomascus*	*hainanus*
296	SCIEA 0503	M1	Male	*Nomascus*	*hainanus*
297	SCIEA 0503	M2	Male	*Nomascus*	*hainanus*
298	ZMVNU M158	M1	Female	*Nomascus*	*leucogenys*
299	ZMVNU M158	M2	Female	*Nomascus*	*leucogenys*
300	ZMVNU M158	M3	Female	*Nomascus*	*leucogenys*
301	ZMVNU M150	M1	Female	*Nomascus*	*leucogenys*
302	ZMVNU M150	M2	Female	*Nomascus*	*leucogenys*
303	ZMVNU M150	M3	Female	*Nomascus*	*leucogenys*
304	ZMVNU M162	M1	Unknown	*Nomascus*	*nasutus*
305	ZMVNU M162	M2	Unknown	*Nomascus*	*nasutus*
306	KIZ 640219	M2	Female	*Hylobates*	*lar*

307	KIZ 640219	M3	Female	*Hylobates*	*lar*
308	KIZ 610006 / 000169	M2	Female	*Nomascus*	*leucogenys*
309	KIZ 610006 / 000169	M2	Female	*Nomascus*	*leucogenys*
310	KIZ 57240	M1	Male	*Nomascus*	*concolor*
311	KIZ 57240	M2	Male	*Nomascus*	*concolor*
312	KIZ 57240	M3	Male	*Nomascus*	*concolor*
313	KIZ 57239 / 000168	M1	Female	*Nomascus*	*concolor*
314	KIZ 57239 / 000168	M2	Female	*Nomascus*	*concolor*
315	KIZ 57239 / 000168	M3	Female	*Nomascus*	*concolor*
316	KIZ 57240 / 000165	M1	Male	*Nomascus*	*concolor*
317	KIZ 57240 / 000165	M2	Male	*Nomascus*	*concolor*
318	KIZ 57240 / 000165	M3	Male	*Nomascus*	*concolor*
319	KIZ 57243 / 000391	M2	Unknown	*Nomascus*	*concolor*
320	KIZ 57243 / 000391	M3	Unknown	*Nomascus*	*concolor*
321	KIZ 57241 / 000170	M1	Unknown	*Nomascus*	*concolor*
322	KIZ 57241 / 000170	M2	Unknown	*Nomascus*	*concolor*
323	KIZ 57241 / 000170	M3	Unknown	*Nomascus*	*concolor*
324	KIZ 57242 / 000167	M1	Female	*Nomascus*	*concolor*
325	KIZ 57242 / 000167	M2	Female	*Nomascus*	*concolor*
326	KIZ 57242 / 000167	M3	Female	*Nomascus*	*concolor*
327	KIZ 640290 / 003152	M1	Female	*Nomascus*	*concolor*
328	KIZ 640290 / 003152	M2	Female	*Nomascus*	*concolor*
329	KIZ 640290 / 003152	M3	Female	*Nomascus*	*concolor*
330	KIZ 210828	M1	Unknown	*Hoolock*	*leuconedys*
331	KIZ 210828	M2	Unknown	*Hoolock*	*leuconedys*
332	KIZ 210828	M3	Unknown	*Hoolock*	*leuconedys*
333	KIZ 2004140	M2	Unknown	*Hoolock*	*leuconedys*
334	KIZ 2004140	M3	Unknown	*Hoolock*	*leuconedys*
335	KIZ 2004139	M2	Unknown	*Hoolock*	*leuconedys*
336	KIZ 2004139	M3	Unknown	*Hoolock*	*leuconedys*
337	KIZ 2004138	M3	Unknown	*Hoolock*	*leuconedys*
338	KIZ 2004142	M1	Unknown	*Hoolock*	*leuconedys*
339	KIZ 2004142	M2	Unknown	*Hoolock*	*leuconedys*
340	KIZ 2004142	M3	Unknown	*Hoolock*	*leuconedys*
341	KIZ 2004137	M2	Male	*Hoolock*	*leuconedys*
342	KIZ 2004137	M3	Male	*Hoolock*	*leuconedys*
343	MCZ 26474	M1	Male	*Hoolock*	*tianxing*
344	MCZ 26474	M2	Male	*Hoolock*	*tianxing*
345	MCZ 27831	M1	Female	*Symphalangus*	*syndactylus*
346	MCZ 27831	M2	Female	*Symphalangus*	*syndactylus*
347	MCZ 27831	M3	Female	*Symphalangus*	*syndactylus*
348	MCZ 30383	M1	Unknown	*Hoolock*	*tianxing*
349	MCZ 30383	M2	Unknown	*Hoolock*	*tianxing*
350	MCZ 30383	M3	Unknown	*Hoolock*	*tianxing*

351	MCZ 36031	M1	Male	*Symphalangus*	*syndactylus*
352	MCZ 36031	M2	Male	*Symphalangus*	*syndactylus*
353	MCZ 36031	M3	Male	*Symphalangus*	*syndactylus*
354	MCZ 38114	M1	Male	*Nomascus*	*concolor*
355	MCZ 38115	M1	Male	*Nomascus*	*concolor*
356	MCZ 38115	M3	Male	*Nomascus*	*concolor*
357	MCZ 38115	M3	Male	*Nomascus*	*concolor*
358	MCZ 38116	M1	Male	*Nomascus*	*concolor*
359	MCZ 38116	M2	Male	*Nomascus*	*concolor*
360	MCZ 38116	M3	Male	*Nomascus*	*concolor*
361	MCZ 41535	M1	Female	*Hylobates*	*lar*
362	MCZ 41535	M2	Female	*Hylobates*	*lar*
363	MCZ 41537	M1	Male	*Hylobates*	*lar*
364	MCZ 41537	M2	Male	*Hylobates*	*lar*
365	MCZ 41546	M1	Female	*Hylobates*	*lar*
366	MCZ 41546	M2	Female	*Hylobates*	*lar*
367	MCZ 41546	M3	Female	*Hylobates*	*lar*
368	NHM 27.12.1.1	M1	Male	*Nomascus*	*gabriellae*
369	NHM 27.12.1.1	M2	Male	*Nomascus*	*gabriellae*
370	NHM 27.12.1.1	M3	Male	*Nomascus*	*gabriellae*
371	NHM 14.12.8.3	M3	Male	*Hylobates*	*lar*
372	NHM 14.12.8.1	M2	Male	*Hylobates*	*lar*
373	NHM 14.12.8.1	M3	Male	*Hylobates*	*lar*
374	NHM 33.4.1.2	M1	Female	*Nomascus*	*concolor*
375	NHM 33.4.1.2	M2	Female	*Nomascus*	*concolor*
376	NHM 33.4.1.2	M3	Female	*Nomascus*	*concolor*
377	NHM 28.7.1.1	M2	Female	*Nomascus*	*leucogenys*
378	NHM 28.7.1.1	M3	Female	*Nomascus*	*leucogenys*
379	NHM 26.10.4.2	M1	Female	*Nomascus*	*leucogenys*
380	NHM 26.10.4.2	M2	Female	*Nomascus*	*leucogenys*
381	NHM 26.10.4.2	M3	Female	*Nomascus*	*leucogenys*
382	NHM 26.10.4.1	M3	Female	*Nomascus*	*leucogenys*
383	NHM 1920.1.26.1	M1	Male	*Symphalangus*	*syndactylus*
384	NHM 1920.1.26.1	M2	Male	*Symphalangus*	*syndactylus*
385	NHM 1920.1.26.1	M3	Male	*Symphalangus*	*syndactylus*
386	USNM 083262	M1	Female	*Hylobates*	*lar*
387	USNM 083262	M2	Female	*Hylobates*	*lar*
388	USNM 083262	M3	Female	*Hylobates*	*lar*
389	USNM 083263	M1	Female	*Hylobates*	*lar*
390	USNM 083263	M2	Female	*Hylobates*	*lar*
391	USNM 083264	M1	Female	*Hylobates*	*lar*
392	USNM 083515	M1	Female	*Hylobates*	*lar*
393	USNM 083515	M2	Female	*Hylobates*	*lar*
394	USNM 083515	M3	Female	*Hylobates*	*lar*

395	USNM 111970	M2	Male	*Hylobates*	*lar*
396	USNM 111970	M3	Male	*Hylobates*	*lar*
397	USNM 111988	M2	Male	*Hylobates*	*lar*
398	USNM 111988	M3	Male	*Hylobates*	*lar*
399	USNM 111989	M2	Male	*Hylobates*	*lar*
400	USNM 111989	M3	Male	*Hylobates*	*lar*
401	USNM 111990	M2	Female	*Hylobates*	*lar*
402	USNM 112574	M2	Male	*Hylobates*	*lar*
403	USNM 113177	M1	Female	*Hylobates*	*agilis*
404	USNM 113177	M2	Female	*Hylobates*	*agilis*
405	USNM 114497	M1	Female	*Symphalangus*	*syndactylus*
406	USNM 114497	M2	Female	*Symphalangus*	*syndactylus*
407	USNM 114497	M3	Female	*Symphalangus*	*syndactylus*
408	USNM 123151	M1	Male	*Hylobates*	*agilis*
409	USNM 123151	M2	Male	*Hylobates*	*agilis*
410	USNM 123151	M3	Male	*Hylobates*	*agilis*
411	USNM 124232	M2	Male	*Hylobates*	*lar*
412	USNM 124232	M3	Male	*Hylobates*	*lar*
413	USNM 124292	M1	Male	*Hylobates*	*lar*
414	USNM 124292	M2	Male	*Hylobates*	*lar*
415	USNM 141160	M1	Male	*Symphalangus*	*syndactylus*
416	USNM 141160	M2	Male	*Symphalangus*	*syndactylus*
417	USNM 141160	M3	Male	*Symphalangus*	*syndactylus*
418	USNM 141161	M2	Female	*Symphalangus*	*syndactylus*
419	USNM 141161	M3	Female	*Symphalangus*	*syndactylus*
420	USNM 141163	M2	Male	*Symphalangus*	*syndactylus*
421	USNM 143577	M1	Male	*Symphalangus*	*syndactylus*
422	USNM 143577	M3	Male	*Symphalangus*	*syndactylus*
423	USNM 196783	M3	Male	*Hylobates*	*muelleri*
424	USNM 198268	M1	Female	*Hylobates*	*muelleri*
425	USNM 198268	M2	Female	*Hylobates*	*muelleri*
426	USNM 198268	M3	Female	*Hylobates*	*muelleri*
427	USNM 198271	M2	Male	*Hylobates*	*muelleri*
428	USNM 198272	M1	Male	*Hylobates*	*muelleri*
429	USNM 198272	M2	Male	*Hylobates*	*muelleri*
430	USNM 198272	M3	Male	*Hylobates*	*muelleri*
431	USNM 198842	M1	Female	*Hylobates*	*muelleri*
432	USNM 198843	M1	Female	*Hylobates*	*muelleri*
433	USNM 198843	M2	Female	*Hylobates*	*muelleri*
434	USNM 199194	M1	Unknown	*Hylobates*	*muelleri*
435	USNM 199194	M2	Unknown	*Hylobates*	*muelleri*
436	USNM 199194	M3	Unknown	*Hylobates*	*muelleri*
437	USNM 201556	M1	Female	*Hylobates*	*pileatus*
438	USNM 201556	M2	Female	*Hylobates*	*pileatus*

439	USNM 201556	M3	Female	*Hylobates*	*pileatus*
440	USNM 240490	M2	Female	*Nomascus*	*leucogenys*
441	USNM 240490	M3	Female	*Nomascus*	*leucogenys*
442	USNM 240491	M3	Female	*Nomascus*	*leucogenys*
443	USNM 240492	M3	Female	*Nomascus*	*leucogenys*
444	USNM 241018	M2	Male	*Hylobates*	*pileatus*
445	USNM 241018	M3	Male	*Hylobates*	*pileatus*
446	USNM 241019	M2	Female	*Hylobates*	*pileatus*
447	USNM 241019	M3	Female	*Hylobates*	*pileatus*
448	USNM 253405	M1	Female	*Hylobates*	*pileatus*
449	USNM 253405	M2	Female	*Hylobates*	*pileatus*
450	USNM 257987	M2	Male	*Hoolock*	sp.
451	USNM 257988	M2	Female	*Hoolock*	sp.
452	USNM 257995	M1	Male	*Nomascus*	*gabriellae*
453	USNM 257995	M2	Male	*Nomascus*	*gabriellae*
454	USNM 257996	M1	Male	*Nomascus*	*gabriellae*
455	USNM 271331	M2	Male	*Hylobates*	*pileatus*
456	USNM 279146	M1	Female	*Hoolock*	*leuconedys*
457	USNM 279146	M2	Female	*Hoolock*	*leuconedys*
458	USNM 296920	M1	Male	*Hylobates*	*pileatus*
459	USNM 296920	M2	Male	*Hylobates*	*pileatus*
460	USNM 296920	M3	Male	*Hylobates*	*pileatus*
461	USNM 296921	M1	Female	*Nomascus*	*leucogenys*
462	USNM 296922	M2	Female	*Hylobates*	*lar*
463	USNM 296922	M3	Female	*Hylobates*	*lar*
464	USNM 296923	M2	Male	*Hylobates*	*lar*
465	USNM 296923	M3	Male	*Hylobates*	*lar*
466	USNM 320787	M1	Female	*Nomascus*	*concolor*
467	USNM 320787	M2	Female	*Nomascus*	*concolor*
468	USNM 320787	M3	Female	*Nomascus*	*concolor*
469	USNM 320789	M1	Male	*Nomascus*	*concolor*
470	USNM 320789	M2	Male	*Nomascus*	*concolor*
471	USNM 320789	M3	Male	*Nomascus*	*concolor*
472	USNM 321549	M1	Male	*Hylobates*	*pileatus*
473	USNM 321549	M2	Male	*Hylobates*	*pileatus*
474	USNM 321549	M3	Male	*Hylobates*	*pileatus*
475	USNM 364967	M1	Female	*Symphalangus*	*syndactylus*
476	USNM 464992	M1	Female	*Nomascus*	*concolor*
477	USNM 464992	M2	Female	*Nomascus*	*concolor*
478	USNM 519573	M3	Female	*Symphalangus*	*syndactylus*
479	USNM 542282	M1	Male	*Nomascus*	*concolor*
480	USNM 542282	M2	Male	*Nomascus*	*concolor*
481	USNM 542282	M3	Male	*Nomascus*	*concolor*

2. Lower dentition

1	AMNH 100048	m1	Male	*Hylobates*	sp.
2	AMNH 101695	m2	Unknown	*Hylobates*	*lar*
3	AMNH 101695	m3	Unknown	*Hylobates*	*lar*
4	AMNH 102026	m1	Female	*Hylobates*	*moloch*
5	AMNH 102026	m2	Female	*Hylobates*	*moloch*
6	AMNH 102093	m2	Male	*Hylobates*	*moloch*
7	AMNH 102093	m3	Male	*Hylobates*	*moloch*
8	AMNH 102161	m1	Male	*Hylobates*	*agilis*
9	AMNH 102161	m2	Male	*Hylobates*	*agilis*
10	AMNH 102161	m3	Male	*Hylobates*	*agilis*
11	AMNH 102162	m1	Male	*Hylobates*	*agilis*
12	AMNH 102162	m2	Male	*Hylobates*	*agilis*
13	AMNH 102189	m1	Male	*Symphalangus*	*syndactylus*
14	AMNH 102190	m2	Female	*Symphalangus*	*syndactylus*
15	AMNH 102193	m1	Male	*Symphalangus*	*syndactylus*
16	AMNH 102193	m2	Male	*Symphalangus*	*syndactylus*
17	AMNH 102194	m2	Unknown	*Symphalangus*	*syndactylus*
18	AMNH 102195	m3	Female	*Symphalangus*	*syndactylus*
19	AMNH 102195	m2	Female	*Symphalangus*	*syndactylus*
20	AMNH 102196	m3	Unknown	*Symphalangus*	*syndactylus*
21	AMNH 102197	m1	Female	*Symphalangus*	*syndactylus*
22	AMNH 102197	m2	Female	*Symphalangus*	*syndactylus*
23	AMNH 102197	m3	Female	*Symphalangus*	*syndactylus*
24	AMNH 102198	m1	Female	*Hylobates*	*agilis*
25	AMNH 102198	m2	Female	*Hylobates*	*agilis*
26	AMNH 102199	m2	Male	*Hylobates*	*agilis*
27	AMNH 102199	m3	Male	*Hylobates*	*agilis*
28	AMNH 102200	m1	Female	*Hylobates*	*agilis*
29	AMNH 102200	m2	Female	*Hylobates*	*agilis*
30	AMNH 102200	m3	Female	*Hylobates*	*agilis*
31	AMNH 102471	m3	Female	*Hylobates*	*agilis*
32	AMNH 102473	m1	Female	*Hylobates*	*agilis*
33	AMNH 102473	m2	Female	*Hylobates*	*agilis*
34	AMNH 102474	m1	Female	*Hylobates*	*agilis*
35	AMNH 102720	m3	Unknown	*Symphalangus*	*syndactylus*
36	AMNH 102721	m2	Female	*Symphalangus*	*syndactylus*
37	AMNH 102721	m3	Female	*Symphalangus*	*syndactylus*
38	AMNH 102722	m1	Female	*Symphalangus*	*syndactylus*
39	AMNH 102722	m2	Female	*Symphalangus*	*syndactylus*
40	AMNH 102724	m2	Male	*Symphalangus*	*syndactylus*
41	AMNH 102724	m3	Male	*Symphalangus*	*syndactylus*
42	AMNH 102725	m2	Male	*Symphalangus*	*syndactylus*
43	AMNH 102725	m3	Male	*Symphalangus*	*syndactylus*
44	AMNH 102727	m2	Female	*Symphalangus*	*syndactylus*

45	AMNH 102729	m1	Male	*Symphalangus*	*syndactylus*
46	AMNH 102729	m2	Male	*Symphalangus*	*syndactylus*
47	AMNH 102771	m2	Unknown	*Hylobates*	*agilis*
48	AMNH 102773	m2	Female	*Hylobates*	*agilis*
49	AMNH 102773	m3	Female	*Hylobates*	*agilis*
50	AMNH 102774	m2	Male	*Hylobates*	*agilis*
51	AMNH 102774	m3	Male	*Hylobates*	*agilis*
52	AMNH 102775	m1	Male	*Hylobates*	*agilis*
53	AMNH 102775	m2	Male	*Hylobates*	*agilis*
54	AMNH 102776	m1	Female	*Hylobates*	*agilis*
55	AMNH 102776	m2	Female	*Hylobates*	*agilis*
56	AMNH 102776	m3	Female	*Hylobates*	*agilis*
57	AMNH 102777	m1	Female	*Hylobates*	*agilis*
58	AMNH 102779	m2	Male	*Hylobates*	*agilis*
59	AMNH 102779	m3	Male	*Hylobates*	*agilis*
60	AMNH 102780	m1	Male	*Hylobates*	*agilis*
61	AMNH 102780	m2	Male	*Hylobates*	*agilis*
62	AMNH 103243	m2	Male	*Hylobates*	*klossii*
63	AMNH 103243	m3	Male	*Hylobates*	*klossii*
64	AMNH 103244	m2	Female	*Hylobates*	*klossii*
65	AMNH 103244	m3	Female	*Hylobates*	*klossii*
66	AMNH 103246	m2	Female	*Hylobates*	*klossii*
67	AMNH 103247	m2	Male	*Hylobates*	*klossii*
68	AMNH 103252	m2	Female	*Hylobates*	*klossii*
69	AMNH 103252	m3	Female	*Hylobates*	*klossii*
70	AMNH 103344	m2	Male	*Hylobates*	*klossii*
71	AMNH 103345	m2	Male	*Hylobates*	*klossii*
72	AMNH 103345	m3	Male	*Hylobates*	*klossii*
73	AMNH 103346	m2	Male	*Hylobates*	*klossii*
74	AMNH 103346	m3	Male	*Hylobates*	*klossii*
75	AMNH 103351	m2	Female	*Hylobates*	*klossii*
76	AMNH 103351	m3	Female	*Hylobates*	*klossii*
77	AMNH 103352	m1	Male	*Hylobates*	*klossii*
78	AMNH 103352	m2	Male	*Hylobates*	*klossii*
79	AMNH 103352	m3	Male	*Hylobates*	*klossii*
80	AMNH 103353	m1	Male	*Hylobates*	*klossii*
81	AMNH 103403	m3	Female	*Hylobates*	*muelleri*
82	AMNH 103441	m1	Male	*Hylobates*	*moloch*
83	AMNH 103441	m2	Male	*Hylobates*	*moloch*
84	AMNH 103441	m3	Male	*Hylobates*	*moloch*
85	AMNH 103442	m1	Female	*Hylobates*	*moloch*
86	AMNH 103442	m2	Female	*Hylobates*	*moloch*
87	AMNH 103442	m3	Female	*Hylobates*	*moloch*
88	AMNH 103443	m1	Female	*Hylobates*	*moloch*

89	AMNH 103443	m2	Female	*Hylobates*	*moloch*
90	AMNH 103443	m3	Female	*Hylobates*	*moloch*
91	AMNH 103444	m1	Female	*Hylobates*	*moloch*
92	AMNH 103444	m2	Female	*Hylobates*	*moloch*
93	AMNH 103445	m3	Male	*Hylobates*	*moloch*
94	AMNH 103446	m1	Male	*Hylobates*	*moloch*
95	AMNH 103446	m2	Male	*Hylobates*	*moloch*
96	AMNH 103448	m1	Female	*Hylobates*	*moloch*
97	AMNH 103448	m2	Female	*Hylobates*	*moloch*
98	AMNH 103448	m3	Female	*Hylobates*	*moloch*
99	AMNH 103449	m2	Female	*Hylobates*	*moloch*
100	AMNH 103449	m3	Female	*Hylobates*	*moloch*
101	AMNH 103452	m1	Female	*Hylobates*	*moloch*
102	AMNH 103454	m1	Male	*Hylobates*	*moloch*
103	AMNH 103454	m2	Male	*Hylobates*	*moloch*
104	AMNH 103665	m3	Female	*Hylobates*	*agilis*
105	AMNH 103665	m2	Female	*Hylobates*	*agilis*
106	AMNH 103666	m3	Male	*Hylobates*	*agilis*
107	AMNH 103723	m3	Male	*Hylobates*	*moloch*
108	AMNH 103725	m2	Female	*Hylobates*	*moloch*
109	AMNH 103726	m1	Male	*Hylobates*	*moloch*
110	AMNH 103726	m2	Male	*Hylobates*	*moloch*
111	AMNH 106053	m2	Male	*Hylobates*	*agilis*
112	AMNH 106053	m3	Male	*Hylobates*	*agilis*
113	AMNH 106322	m1	Male	*Hylobates*	*moloch*
114	AMNH 106322	m2	Male	*Hylobates*	*moloch*
115	AMNH 106326	m2	Female	*Hylobates*	*moloch*
116	AMNH 106327	m2	Female	*Hylobates*	*moloch*
117	AMNH 106327	m3	Female	*Hylobates*	*moloch*
118	AMNH 106328	m2	Female	*Hylobates*	*moloch*
119	AMNH 106328	m3	Female	*Hylobates*	*moloch*
120	AMNH 106330	m2	Male	*Hylobates*	*moloch*
121	AMNH 106330	m3	Male	*Hylobates*	*moloch*
122	AMNH 106332	m3	Female	*Hylobates*	*moloch*
123	AMNH 106571	m1	Male	*Hylobates*	*agilis*
124	AMNH 106571	m2	Male	*Hylobates*	*agilis*
125	AMNH 106571	m3	Male	*Hylobates*	*agilis*
126	AMNH 106572	m2	Male	*Hylobates*	*agilis*
127	AMNH 106572	m3	Male	*Hylobates*	*agilis*
128	AMNH 106573	m2	Female	*Hylobates*	*agilis*
129	AMNH 106573	m3	Female	*Hylobates*	*agilis*
130	AMNH 106576	m3	Male	*Hylobates*	*agilis*
131	AMNH 106578	m2	Male	*Hylobates*	*agilis*
132	AMNH 106578	m3	Male	*Hylobates*	*agilis*

133	AMNH 106579	m1	Male	*Hylobates*	*agilis*
134	AMNH 106579	m2	Male	*Hylobates*	*agilis*
135	AMNH 106579	m3	Male	*Hylobates*	*agilis*
136	AMNH 106580	m2	Female	*Hylobates*	*agilis*
137	AMNH 106580	m3	Female	*Hylobates*	*agilis*
138	AMNH 106582	m2	Female	*Symphalangus*	*syndactylus*
139	AMNH 106582	m3	Female	*Symphalangus*	*syndactylus*
140	AMNH 106583	m2	Female	*Symphalangus*	*syndactylus*
141	AMNH 106672	m2	Male	*Hylobates*	*agilis*
142	AMNH 106675	m2	Male	*Hylobates*	*agilis*
143	AMNH 106675	m3	Male	*Hylobates*	*agilis*
144	AMNH 106676	m2	Male	*Hylobates*	*agilis*
145	AMNH 106676	m3	Male	*Hylobates*	*agilis*
146	AMNH 106677	m1	Female	*Hylobates*	*agilis*
147	AMNH 106677	m2	Female	*Hylobates*	*agilis*
148	AMNH 106678	m2	Female	*Hylobates*	*agilis*
149	AMNH 106678	m3	Female	*Hylobates*	*agilis*
150	AMNH 106679	m1	Female	*Hylobates*	*agilis*
151	AMNH 106679	m3	Female	*Hylobates*	*agilis*
152	AMNH 106779	m2	Female	*Hylobates*	*agilis*
153	AMNH 106781	m1	Female	*Hylobates*	*moloch*
154	AMNH 106781	m2	Female	*Hylobates*	*moloch*
155	AMNH 106781	m3	Female	*Hylobates*	*moloch*
156	AMNH 106782	m1	Female	*Hylobates*	*moloch*
157	AMNH 106782	m2	Female	*Hylobates*	*moloch*
158	AMNH 106782	m3	Female	*Hylobates*	*moloch*
159	AMNH 106783	m2	Female	*Hylobates*	*moloch*
160	AMNH 106788	m1	Female	*Hylobates*	*moloch*
161	AMNH 106788	m2	Female	*Hylobates*	*moloch*
162	AMNH 106788	m3	Female	*Hylobates*	*moloch*
163	AMNH 106789	m2	Male	*Hylobates*	*moloch*
164	AMNH 107102	m2	Unknown	*Hylobates*	*moloch*
165	AMNH 107102	m3	Unknown	*Hylobates*	*moloch*
166	AMNH 112667	m1	Female	*Hoolock*	*leuconedys*
167	AMNH 112667	m2	Female	*Hoolock*	*leuconedys*
168	AMNH 112667	m3	Female	*Hoolock*	*leuconedys*
169	AMNH 112668	m2	Male	*Hoolock*	*leuconedys*
170	AMNH 112669	m1	Female	*Hoolock*	*leuconedys*
171	AMNH 112670	m1	Female	*Hoolock*	*leuconedys*
172	AMNH 112670	m2	Female	*Hoolock*	*leuconedys*
173	AMNH 112670	m3	Female	*Hoolock*	*leuconedys*
174	AMNH 112671	m1	Male	*Hoolock*	*leuconedys*
175	AMNH 112671	m2	Male	*Hoolock*	*leuconedys*
176	AMNH 112671	m3	Male	*Hoolock*	*leuconedys*

177	AMNH 112674	m2	Female	*Hoolock*	*leuconedys*
178	AMNH 112674	m3	Female	*Hoolock*	*leuconedys*
179	AMNH 112677	m1	Female	*Hoolock*	*leuconedys*
180	AMNH 112677	m2	Female	*Hoolock*	*leuconedys*
181	AMNH 112679	m1	Female	*Hoolock*	*leuconedys*
182	AMNH 112679	m2	Female	*Hoolock*	*leuconedys*
183	AMNH 112680	m3	Female	*Hoolock*	*leuconedys*
184	AMNH 112683	m1	Male	*Hoolock*	*leuconedys*
185	AMNH 112683	m2	Male	*Hoolock*	*leuconedys*
186	AMNH 112683	m3	Male	*Hoolock*	*leuconedys*
187	AMNH 112685	m1	Male	*Hoolock*	*leuconedys*
188	AMNH 112685	m2	Male	*Hoolock*	*leuconedys*
189	AMNH 112687	m2	Female	*Hoolock*	*leuconedys*
190	AMNH 112688	m2	Female	*Hoolock*	*hoolock*
191	AMNH 112688	m3	Female	*Hoolock*	*hoolock*
192	AMNH 112689	m1	Male	*Hoolock*	*hoolock*
193	AMNH 112690	m2	Female	*Hoolock*	*hoolock*
194	AMNH 112690	m3	Female	*Hoolock*	*hoolock*
195	AMNH 112691	m1	Male	*Hoolock*	*hoolock*
196	AMNH 112691	m2	Male	*Hoolock*	*hoolock*
197	AMNH 112692	m3	Male	*Hoolock*	*hoolock*
198	AMNH 112694	m2	Male	*Hoolock*	*hoolock*
199	AMNH 112694	m3	Male	*Hoolock*	*hoolock*
200	AMNH 112696	m1	Male	*Hoolock*	*hoolock*
201	AMNH 112697	m1	Female	*Hoolock*	*hoolock*
202	AMNH 112697	m2	Female	*Hoolock*	*hoolock*
203	AMNH 112697	m3	Female	*Hoolock*	*hoolock*
204	AMNH 112698	m2	Male	*Hoolock*	*hoolock*
205	AMNH 112698	m3	Male	*Hoolock*	*hoolock*
206	AMNH 112699	m1	Female	*Hoolock*	*hoolock*
207	AMNH 112700	m1	Male	*Hoolock*	*hoolock*
208	AMNH 112702	m2	Male	*Hoolock*	*hoolock*
209	AMNH 112702	m3	Male	*Hoolock*	*hoolock*
210	AMNH 112703	m1	Male	*Hoolock*	*hoolock*
211	AMNH 112703	m2	Male	*Hoolock*	*hoolock*
212	AMNH 112703	m3	Male	*Hoolock*	*hoolock*
213	AMNH 112704	m3	Male	*Hoolock*	*hoolock*
214	AMNH 112706	m2	Male	*Hoolock*	*hoolock*
215	AMNH 112710	m2	Male	*Hoolock*	*hoolock*
216	AMNH 112711	m2	Female	*Hoolock*	*leuconedys*
217	AMNH 112711	m3	Female	*Hoolock*	*leuconedys*
218	AMNH 112713	m2	Male	*Hoolock*	*leuconedys*
219	AMNH 112713	m3	Male	*Hoolock*	*leuconedys*
220	AMNH 112716	m2	Male	*Hoolock*	*leuconedys*

221	AMNH 112716	m3	Male	*Hoolock*	*leuconedys*
222	AMNH 112717	m3	Female	*Hoolock*	*leuconedys*
223	AMNH 112719	m3	Female	*Hoolock*	sp.
224	AMNH 112720	m2	Male	*Hoolock*	sp.
225	AMNH 112720	m3	Male	*Hoolock*	sp.
226	AMNH 112721	m1	Female	*Hoolock*	sp.
227	AMNH 112721	m2	Female	*Hoolock*	sp.
228	AMNH 112960	m2	Male	*Hoolock*	*leuconedys*
229	AMNH 112960	m3	Male	*Hoolock*	*leuconedys*
230	AMNH 112962	m1	Female	*Hoolock*	*leuconedys*
231	AMNH 112962	m2	Female	*Hoolock*	*leuconedys*
232	AMNH 112965	m1	Female	*Hoolock*	*leuconedys*
233	AMNH 112965	m2	Female	*Hoolock*	*leuconedys*
234	AMNH 114546	m3	Female	*Hoolock*	sp.
235	AMNH 119601	m2	Unknown	*Hylobates*	*lar*
236	AMNH 119624	m2	Unknown	*Hoolock*	sp.
237	AMNH 130172	m1	Unknown	*Hylobates*	*moloch*
238	AMNH 130172	m2	Unknown	*Hylobates*	*moloch*
239	AMNH 140230	m2	Unknown	*Hylobates*	*lar*
240	AMNH 146725	m2	Male	*Hylobates*	sp.
241	AMNH 163630	m2	Male	*Hoolock*	*hoolock*
242	AMNH 163630	m3	Male	*Hoolock*	*hoolock*
243	AMNH 163632	m2	Male	*Hoolock*	*hoolock*
244	AMNH 163632	m3	Male	*Hoolock*	*hoolock*
245	AMNH 19400	m1	Unknown	*Hoolock*	sp.
246	AMNH 200752	m2	Female	*Hylobates*	*lar*
247	AMNH 200853	m1	Female	*Hylobates*	*moloch*
248	AMNH 200853	m2	Female	*Hylobates*	*moloch*
249	AMNH 202384	m1	Male	*Hylobates*	*lar*
250	AMNH 202384	m2	Male	*Hylobates*	*lar*
251	AMNH 32636	m1	Male	*Hylobates*	*muelleri*
252	AMNH 32636	m2	Male	*Hylobates*	*muelleri*
253	AMNH 32636	m3	Male	*Hylobates*	*muelleri*
254	AMNH 41342	m2	Unknown	*Hylobates*	*moloch*
255	AMNH 41342	m3	Unknown	*Hylobates*	*moloch*
256	AMNH 43063	m1	Female	*Hoolock*	sp.
257	AMNH 43064	m1	Female	*Hoolock*	sp.
258	AMNH 54659	m1	Female	*Hylobates*	*lar*
259	AMNH 54659	m2	Female	*Hylobates*	*lar*
260	AMNH 54662	m1	Female	*Hylobates*	*lar*
261	AMNH 54662	m2	Female	*Hylobates*	*lar*
262	AMNH 54662	m3	Female	*Hylobates*	*lar*
263	AMNH 54966	m1	Male	*Hylobates*	*lar*
264	AMNH 54966	m2	Male	*Hylobates*	*lar*

265	AMNH 83413	m2	Male	*Hoolock*	*hoolock*
266	AMNH 83413	m3	Male	*Hoolock*	*hoolock*
267	AMNH 83414	m1	Male	*Hoolock*	*hoolock*
268	AMNH 83414	m2	Male	*Hoolock*	*hoolock*
269	AMNH 83415	m1	Male	*Hoolock*	*hoolock*
270	AMNH 83415	m2	Male	*Hoolock*	*hoolock*
271	AMNH 83415	m3	Male	*Hoolock*	*hoolock*
272	AMNH 83417	m2	Male	*Hoolock*	*hoolock*
273	AMNH 83417	m3	Male	*Hoolock*	*hoolock*
274	AMNH 83418	m1	Female	*Hoolock*	*hoolock*
275	AMNH 83418	m2	Female	*Hoolock*	*hoolock*
276	AMNH 83422	m2	Male	*Hoolock*	*hoolock*
277	AMNH 83423	m2	Female	*Hoolock*	*hoolock*
278	AMNH 83424	m1	Male	*Hoolock*	*hoolock*
279	AMNH 83427	m1	Male	*Hoolock*	*hoolock*
280	AMNH 87252	m2	Male	*Nomascus*	*concolor*
281	AMNH 87252	m3	Male	*Nomascus*	*concolor*
282	AMNH 90268	m2	Female	*Symphalangus*	*syndactylus*
283	AMNH 90337	m2	Unknown	*Symphalangus*	*syndactylus*
284	AMNH 99340	m1	Female	*Hoolock*	sp.
285	IOZ 25965	m1	Unknown	*Hoolock*	*tianxing*
286	IOZ 25965	m2	Unknown	*Hoolock*	*tianxing*
287	IOZ 14517 / 80570	m3	Unknown	*Nomascus*	*leucogenys*
288	IOZ 17940	m1	Male	*Nomascus*	*concolor*
289	IOZ 17940	m2	Male	*Nomascus*	*concolor*
290	IOZ 17940	m3	Male	*Nomascus*	*concolor*
291	IOZ 19552	m1	Female	*Nomascus*	*leucogenys*
292	IOZ 19552	m2	Female	*Nomascus*	*leucogenys*
293	IOZ 19552	m3	Female	*Nomascus*	*leucogenys*
294	SCIEA 0088	m1	Female	*Nomascus*	*hainanus*
295	SCIEA 0088	m2	Female	*Nomascus*	*hainanus*
296	SCIEA 0088	m3	Female	*Nomascus*	*hainanus*
297	SCIEA 0502	m1	Female	*Nomascus*	*hainanus*
298	SCIEA 0502	m2	Female	*Nomascus*	*hainanus*
299	SCIEA 0502	m3	Female	*Nomascus*	*hainanus*
300	SCIEA 0503	m2	Male	*Nomascus*	*hainanus*
301	SCIEA 0503	m3	Male	*Nomascus*	*hainanus*
302	ZMVNU M159	m1	Unknown	*Nomascus*	*nasutus*
303	ZMVNU M159	m3	Unknown	*Nomascus*	*nasutus*
304	ZMVNU M159	m2	Unknown	*Nomascus*	*nasutus*
305	ZMVNU M150	m2	Female	*Nomascus*	*leucogenys*
306	ZMVNU M150	m3	Female	*Nomascus*	*leucogenys*
307	ZMVNU M162	m1	Unknown	*Nomascus*	*nasutus*
308	ZMVNU M162	m2	Unknown	*Nomascus*	*nasutus*

309	ZMVNU M162	m3	Unknown	*Nomascus*	*nasutus*
310	KIZ 640219	m2	Female	*Hylobates*	*lar*
311	KIZ 640219	m3	Female	*Hylobates*	*lar*
312	KIZ 610006 / 000169	m1	Female	*Nomascus*	*leucogenys*
313	KIZ 610006 / 000169	m3	Female	*Nomascus*	*leucogenys*
314	KIZ 57240	m2	Male	*Nomascus*	*concolor*
315	KIZ 57240	m3	Male	*Nomascus*	*concolor*
316	KIZ 57239 / 000168	m2	Female	*Nomascus*	*concolor*
317	KIZ 57239 / 000168	m3	Female	*Nomascus*	*concolor*
318	KIZ 57243 / 000391	m1	Unknown	*Nomascus*	*concolor*
319	KIZ 57243 / 000391	m2	Unknown	*Nomascus*	*concolor*
320	KIZ 57243 / 000391	m3	Unknown	*Nomascus*	*concolor*
321	KIZ 57241 / 000170	m1	Unknown	*Nomascus*	*concolor*
322	KIZ 57241 / 000170	m2	Unknown	*Nomascus*	*concolor*
323	KIZ 57241 / 000170	m3	Unknown	*Nomascus*	*concolor*
324	KIZ 57242 / 000167	m1	Female	*Nomascus*	*concolor*
325	KIZ 57242 / 000167	m2	Female	*Nomascus*	*concolor*
326	KIZ 57242 / 000167	m3	Female	*Nomascus*	*concolor*
327	KIZ 640290 / 003152	m2	Female	*Nomascus*	*concolor*
328	KIZ 640290 / 003152	m3	Female	*Nomascus*	*concolor*
329	KIZ 210828	m2	Unknown	*Hoolock*	*leuconedys*
330	KIZ 210828	m3	Unknown	*Hoolock*	*leuconedys*
331	MCZ 26474	m1	Male	*Hoolock*	*tianxing*
332	MCZ 26474	m2	Male	*Hoolock*	*tianxing*
333	MCZ 27831	m2	Female	*Symphalangus*	*syndactylus*
334	MCZ 27831	m3	Female	*Symphalangus*	*syndactylus*
335	MCZ 30383	m1	Unknown	*Hoolock*	*tianxing*
336	MCZ 30383	m2	Unknown	*Hoolock*	*tianxing*
337	MCZ 30383	m3	Unknown	*Hoolock*	*tianxing*
338	MCZ 36031	m1	Male	*Symphalangus*	*syndactylus*
339	MCZ 36031	m2	Male	*Symphalangus*	*syndactylus*
340	MCZ 36031	m3	Male	*Symphalangus*	*syndactylus*
341	MCZ 38114	m1	Male	*Nomascus*	*concolor*
342	MCZ 38115	m1	Male	*Nomascus*	*concolor*
343	MCZ 38115	m2	Male	*Nomascus*	*concolor*
344	MCZ 38115	m3	Male	*Nomascus*	*concolor*
345	MCZ 38116	m2	Male	*Nomascus*	*concolor*
346	MCZ 38116	m3	Male	*Nomascus*	*concolor*
347	MCZ 41535	m1	Female	*Hylobates*	*lar*
348	MCZ 41535	m2	Female	*Hylobates*	*lar*
349	MCZ 41537	m1	Male	*Hylobates*	*lar*
350	MCZ 41537	m2	Male	*Hylobates*	*lar*
351	MCZ 41546	m2	Female	*Hylobates*	*lar*
352	MCZ 41546	m3	Female	*Hylobates*	*lar*

353	NHM 27.12.1.1	m2	Male	*Nomascus*	*gabriellae*
354	NHM 27.12.1.1	m3	Male	*Nomascus*	*gabriellae*
355	NHM 14.12.8.1	m3	Male	*Hylobates*	*lar*
356	NHM 28.7.1.1	m1	Female	*Nomascus*	*leucogenys*
357	NHM 28.7.1.1	m3	Female	*Nomascus*	*leucogenys*
358	NHM 1920.1.26.1	m1	Male	*Symphalangus*	*syndactylus*
359	NHM 1920.1.26.1	m2	Male	*Symphalangus*	*syndactylus*
360	NHM 1920.1.26.1	m3	Male	*Symphalangus*	*syndactylus*
361	USNM 083262	m1	Female	*Hylobates*	*lar*
362	USNM 083262	m2	Female	*Hylobates*	*lar*
363	USNM 083262	m3	Female	*Hylobates*	*lar*
364	USNM 083263	m1	Female	*Hylobates*	*lar*
365	USNM 083263	m2	Female	*Hylobates*	*lar*
366	USNM 083264	m2	Female	*Hylobates*	*lar*
367	USNM 083515	m3	Female	*Hylobates*	*lar*
368	USNM 111970	m2	Male	*Hylobates*	*lar*
369	USNM 111970	m3	Male	*Hylobates*	*lar*
370	USNM 111988	m2	Male	*Hylobates*	*lar*
371	USNM 111988	m3	Male	*Hylobates*	*lar*
372	USNM 111989	m1	Male	*Hylobates*	*lar*
373	USNM 111989	m2	Male	*Hylobates*	*lar*
374	USNM 111989	m3	Male	*Hylobates*	*lar*
375	USNM 111990	m1	Female	*Hylobates*	*lar*
376	USNM 112574	m2	Male	*Hylobates*	*lar*
377	USNM 113177	m1	Female	*Hylobates*	*agilis*
378	USNM 113177	m2	Female	*Hylobates*	*agilis*
379	USNM 114497	m1	Female	*Symphalangus*	*syndactylus*
380	USNM 114497	m2	Female	*Symphalangus*	*syndactylus*
381	USNM 114497	m3	Female	*Symphalangus*	*syndactylus*
382	USNM 115502	m3	Female	*Hylobates*	*lar*
383	USNM 123151	m2	Male	*Hylobates*	*agilis*
384	USNM 124232	m3	Male	*Hylobates*	*lar*
385	USNM 124292	m2	Male	*Hylobates*	*lar*
386	USNM 124292	m3	Male	*Hylobates*	*lar*
387	USNM 141160	m1	Male	*Symphalangus*	*syndactylus*
388	USNM 141160	m2	Male	*Symphalangus*	*syndactylus*
389	USNM 141160	m3	Male	*Symphalangus*	*syndactylus*
390	USNM 141163	m2	Male	*Symphalangus*	*syndactylus*
391	USNM 196781	m1	Male	*Hylobates*	*muelleri*
392	USNM 196781	m3	Male	*Hylobates*	*muelleri*
393	USNM 196783	m1	Male	*Hylobates*	*muelleri*
394	USNM 196783	m2	Male	*Hylobates*	*muelleri*
395	USNM 196783	m3	Male	*Hylobates*	*muelleri*
396	USNM 198268	m1	Female	*Hylobates*	*muelleri*

397	USNM 198268	m2	Female	*Hylobates*	*muelleri*
398	USNM 198268	m3	Female	*Hylobates*	*muelleri*
399	USNM 198271	m1	Male	*Hylobates*	*muelleri*
400	USNM 198271	m2	Male	*Hylobates*	*muelleri*
401	USNM 198272	m1	Male	*Hylobates*	*muelleri*
402	USNM 198272	m3	Male	*Hylobates*	*muelleri*
403	USNM 198842	m1	Female	*Hylobates*	*muelleri*
404	USNM 198842	m2	Female	*Hylobates*	*muelleri*
405	USNM 198843	m1	Female	*Hylobates*	*muelleri*
406	USNM 199194	m1	Unknown	*Hylobates*	*muelleri*
407	USNM 199194	m3	Unknown	*Hylobates*	*muelleri*
408	USNM 199196	m1	Male	*Hylobates*	*muelleri*
409	USNM 199196	m2	Male	*Hylobates*	*muelleri*
410	USNM 199196	m3	Male	*Hylobates*	*muelleri*
411	USNM 201556	m1	Female	*Hylobates*	*pileatus*
412	USNM 201556	m2	Female	*Hylobates*	*pileatus*
413	USNM 240490	m3	Female	*Nomascus*	*leucogenys*
414	USNM 241018	m1	Male	*Hylobates*	*pileatus*
415	USNM 241019	m1	Female	*Hylobates*	*pileatus*
416	USNM 241019	m2	Female	*Hylobates*	*pileatus*
417	USNM 241019	m3	Female	*Hylobates*	*pileatus*
418	USNM 253405	m1	Female	*Hylobates*	*pileatus*
419	USNM 253405	m2	Female	*Hylobates*	*pileatus*
420	USNM 257988	m2	Female	*Hoolock*	sp.
421	USNM 257988	m3	Female	*Hoolock*	sp.
422	USNM 257995	m1	Male	*Nomascus*	*gabriellae*
423	USNM 257995	m2	Male	*Nomascus*	*gabriellae*
424	USNM 257996	m1	Male	*Nomascus*	*gabriellae*
425	USNM 271331	m2	Male	*Hylobates*	*pileatus*
426	USNM 271331	m3	Male	*Hylobates*	*pileatus*
427	USNM 279146	m2	Female	*Hoolock*	*leuconedys*
428	USNM 296920	m1	Male	*Hylobates*	*pileatus*
429	USNM 296920	m2	Male	*Hylobates*	*pileatus*
430	USNM 296920	m3	Male	*Hylobates*	*pileatus*
431	USNM 296921	m1	Female	*Nomascus*	*leucogenys*
432	USNM 296922	m1	Female	*Hylobates*	*lar*
433	USNM 296922	m2	Female	*Hylobates*	*lar*
434	USNM 296922	m3	Female	*Hylobates*	*lar*
435	USNM 296923	m1	Male	*Hylobates*	*lar*
436	USNM 296923	m2	Male	*Hylobates*	*lar*
437	USNM 296923	m3	Male	*Hylobates*	*lar*
438	USNM 320786	m1	Male	*Nomascus*	*concolor*
439	USNM 320787	m1	Female	*Nomascus*	*concolor*
440	USNM 320787	m2	Female	*Nomascus*	*concolor*

441	USNM 321549	m1	Male	*Hylobates*	*pileatus*
442	USNM 321549	m2	Male	*Hylobates*	*pileatus*
443	USNM 364967	m1	Female	*Symphalangus*	*syndactylus*
444	USNM 395514	m2	Male	*Symphalangus*	*syndactylus*
445	USNM 395514	m3	Male	*Symphalangus*	*syndactylus*
446	USNM 464992	m1	Female	*Nomascus*	*concolor*
447	USNM 464992	m2	Female	*Nomascus*	*concolor*
448	USNM 464992	m3	Female	*Nomascus*	*concolor*
449	USNM 519573	m3	Female	*Symphalangus*	*syndactylus*
450	USNM 542282	m3	Male	*Nomascus*	*concolor*
451	AMNH 18534	m2	Unknown	*Bunopithecus*	*sericus*

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SUMMARY:

Taxon	UM1	UM2	UM3
M1K12:3	1	1	1
Bunopithecus	-	-	-
Hylobates	65	98	69
Hoolock	41	51	31
Symphalangus	11	18	12
Nomascus	28	30	27

Total individuals:	129	*Hylobates*
	77	*Hoolock*
	32	*Symphalangus*
	41	*Nomascus*
	279	**TOTAL**

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LM1	LM2
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62	100
30	44
10	22
19	21